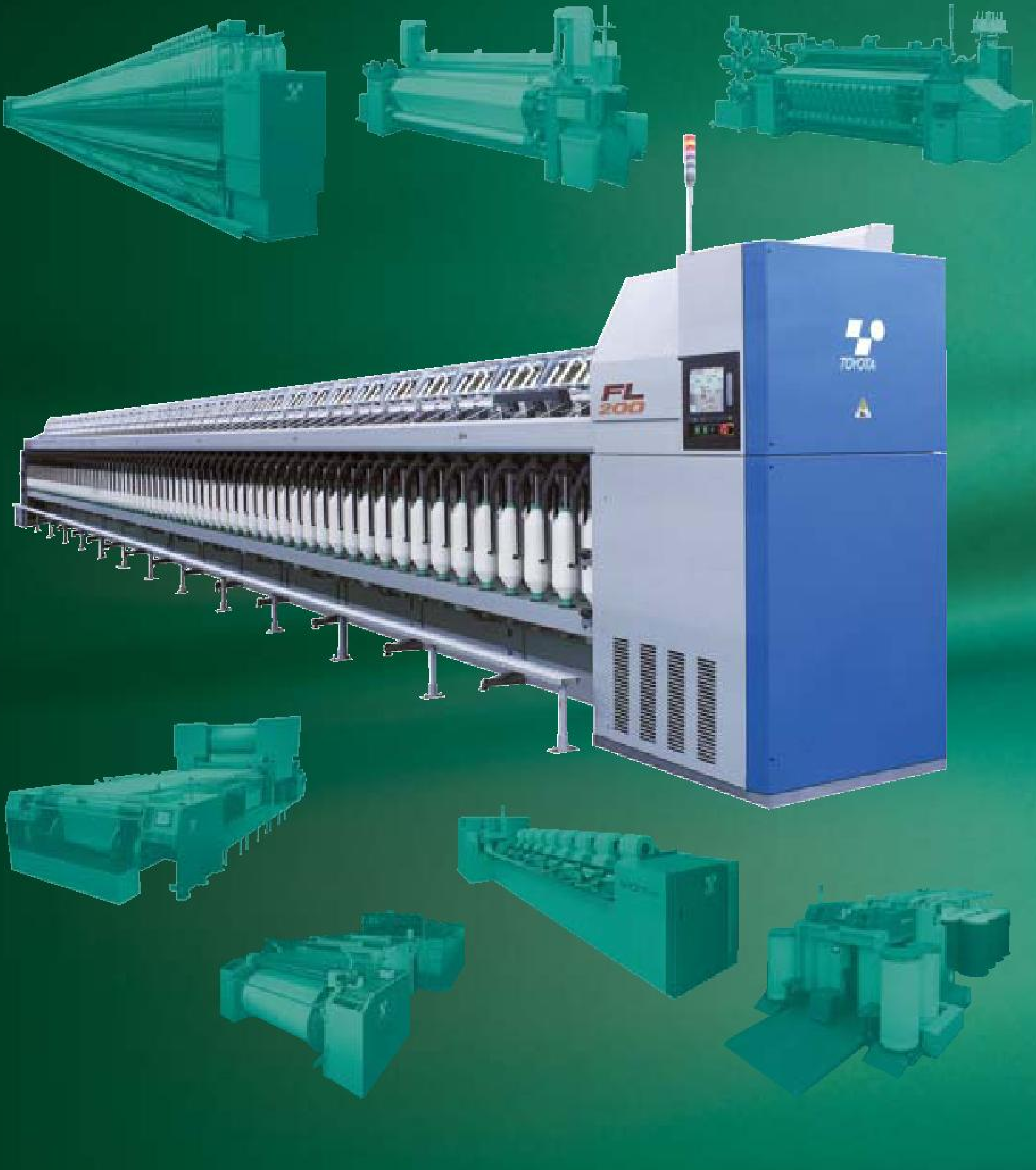
TOYOTA

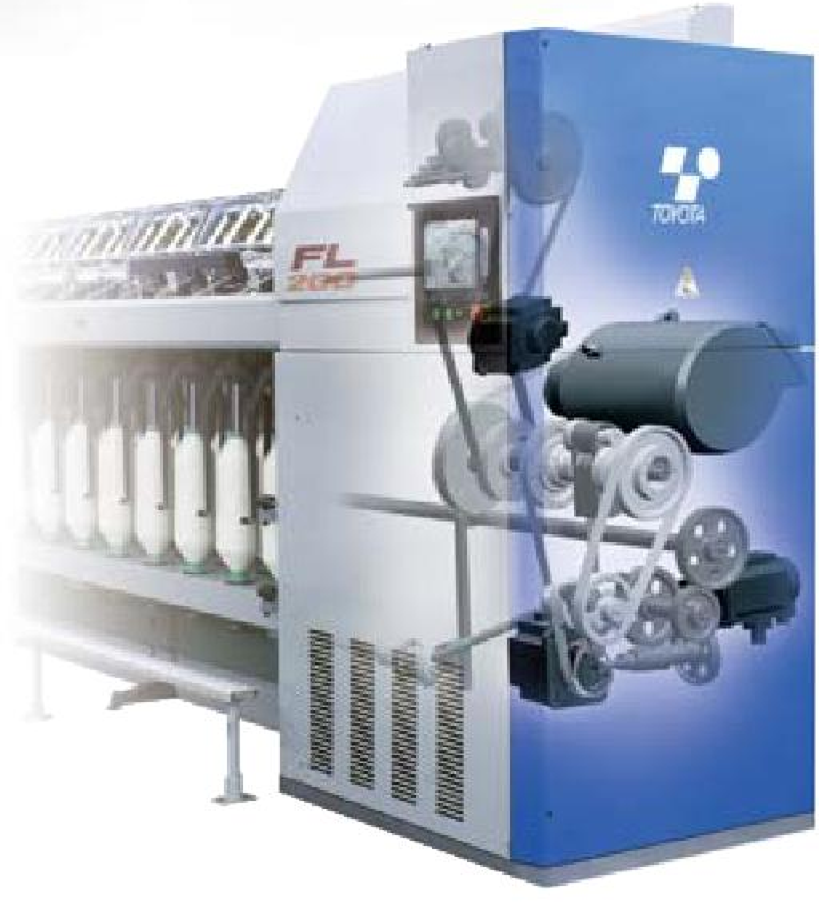
Roving Frame FL200


TOYOTA
FL 200

The Convergence of Advanced Technology and Tradition

The new FL200 was born out of Toyota's unending pursuit of the ideal roving frame, one that enables anyone to spin high-quality roving at high speeds, the aim of the original FL100.

The three-motor drive established in the FL100 has evolved and developed into a four-motor drive, and the latest in servo technology and dramatically improved CPU performance provides even greater accuracy and control. New intelligent features have been added to the FL200, enabling the machine to "think for itself" and become a detail-oriented assistant facilitating the customer's operations. Combined with the synergy of a high-performance tension controller, the FL200 guarantees our customers a roving process one rank above all others in every aspect of performance, including productivity, operability, and roving quality.



Newly Developed Four-Motor Drive

- Main motor drives flyers
- Draft motor drives bottom rollers
- Winding motor drives bobbins
- Lifting motor drives bobbin rail

Roving Frame FL200

10.5-inch color function panel

FL
200
TOYOTA

Outstanding Productivity

FL200
Roving Frame

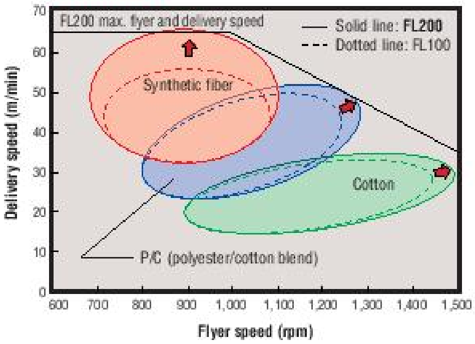
High-speed flyer

To maintain optimum output quality in high-speed operation, the FL200 uses a flyer designed especially for high-speed performance. An internal stainless steel tubular roving guide connecting directly to the presser protects against the adverse effects of air turbulence, dust, and fly in high-speed production. As a result, the FL200 operates dependably at speeds up to 1,500 rpm.

Automatic flyer speed control device with inverter

By simply inputting the average flyer speed and basic roving conditions such as fiber length and roving count, the computer automatically establishes the correct speed progression pattern and adjusts flyer speed via inverter to maintain a constant centrifugal force on the roving. This results in reduced roving breakage for improved efficiency and ease of operation.

Productivity

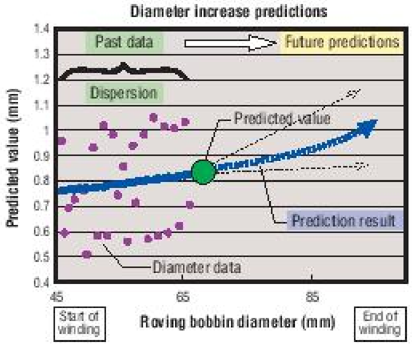


Advanced control system ensures simple, easy production of optimal packages

A test run is normally required when roving new yarn types and yarn counts to determine the amount of increase in the bobbin diameter and input to the roving frame. The FL200 has completely eliminated this troublesome operation: in addition to an automatic calculation function for bobbin diameter increase based on the database inherited from the FL100, we have added a new control feature that successively predicts and corrects the actual amount of increase in bobbin diameter based on continuously accumulated operational data. As a result, actual conditions can be determined with greater accuracy, consistently providing the optimum package size with the optimal tension without the need to do a roving test. In addition, the database itself is automatically updated based on actual operation. The more this learning function is used, the greater the consistency in the roving packages.

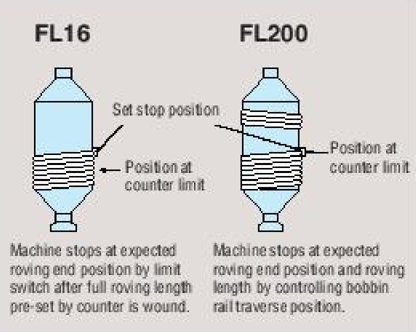
Bobbin diameter increase predictions & actual results

(CD250gr/30yd NF:1,100rpm)



Automatic stop at fixed roving length and position

The FL200's microcomputer control makes it possible to stop roving at both a fixed position and a specified length. The FL200 automatically returns to the set position once the length limit has been reached. Production yield improves because the length of the roving actually wound falls within ±1 meter of the specified length.



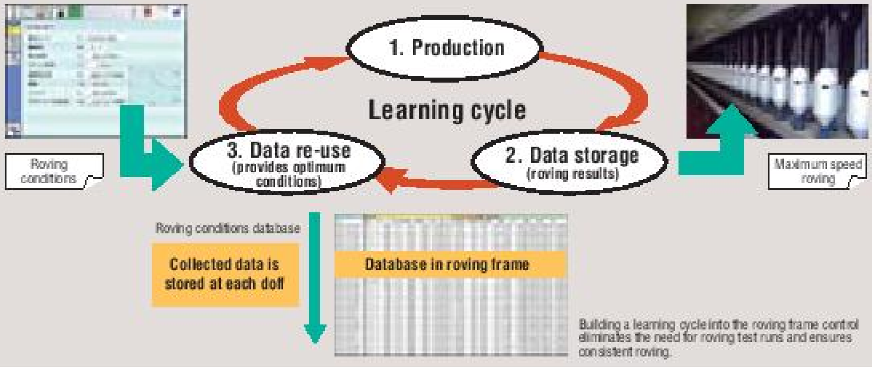
Machine stops at expected roving end position by limit switch after full roving length pre-set by counter is wound.

Machine stops at expected roving end position and roving length by controlling bobbin rail traverse position.

Model \ Sliver type	Wasted roving	
	Carded Ne20	Combed Ne40
FL200	0.068%	0.056%
FL16	1.35%	1.34%

Package formation learning function

Learning function eliminates roving test runs and ensures consistent roving packages.



Building a learning cycle into the roving frame control eliminates the need for roving test runs and ensures consistent roving.

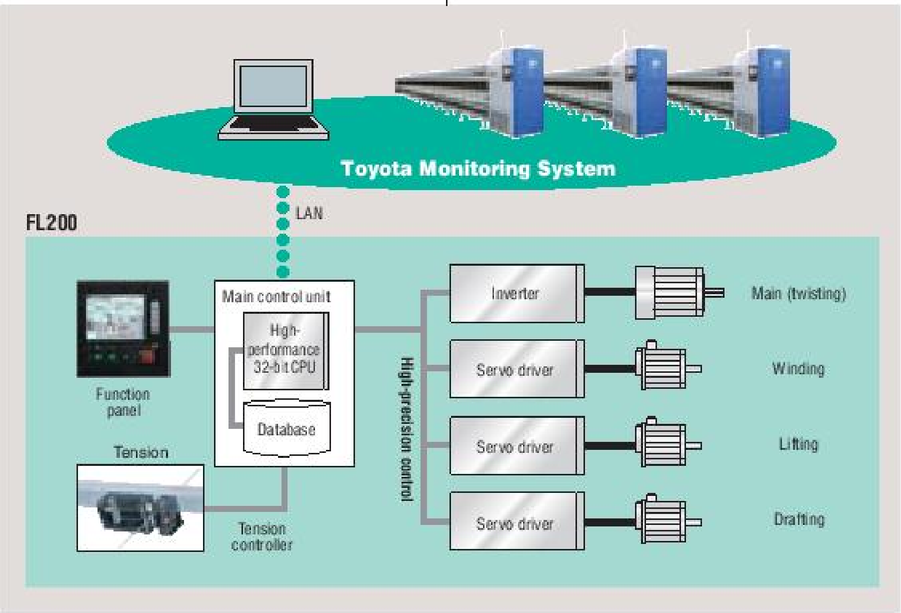
High-Quality Roving

High-performance sensors, a newly developed CPU, and the latest in servo technology deliver the ultimate in winding tension control

The combination of a microcomputer and CCD ‘electronic eye’ sensors accurate to the 0.1-mm level maintains ideal winding tension for even the finest count. This system also ensures uniform tension between all frames in a production group, a difficult feat with conventional manual adjustments.

In addition, the computer stores settings according to various criteria—flyer speed, fiber type, etc.—and automatically sets the appropriate tension, eliminating the need for frequent setup adjustments.

The merging of servo technology providing optimal control functions and the newly developed four-motor drive system into this high-performance tension controller delivers the ultimate in winding tension control.

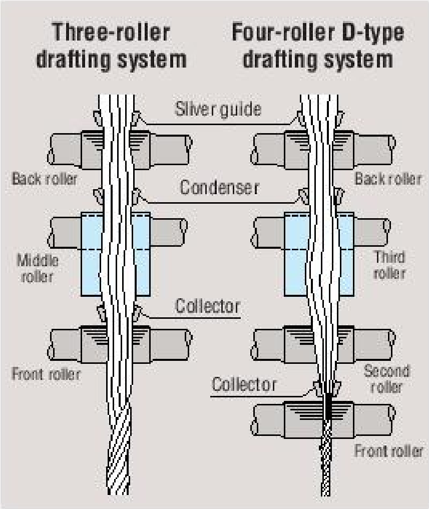

Toyota Monitoring System
LAN
FL200
Main control unit
High-performance 32-bit CPU
Database
Function panel
Tension
Tension controller
High-precision control
Inverter
Servo driver
Servo driver
Servo driver
Main (twisting)
Winding
Lifting
Drafting

FL 200

Roving Frame

Four-roller drafting system for smooth, soft roving

The FL200 is equipped with the four-roller drafting system proven effective and favorably evaluated by customers. This system places a collector between the front and second rollers, separating drafting and collecting zones for superior roving softness and smoothness.


Three-roller drafting system
Four-roller D-type drafting system
Sliver guide
Back roller
Condenser
Back roller
Middle roller
Third roller
Collector
Front roller
Collector
Second roller
Front roller

Creel tension fine adjustment mechanism

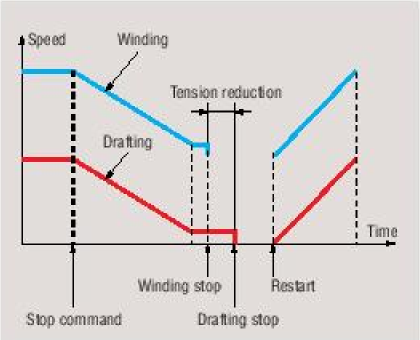
OPTION

When roving combed cotton, sliver is stretched slightly in feeding from can to drafting section. The degree of elongation and thus the evenness of the roving can vary somewhat depending on the relative can position. To overcome this variance, the FL200 offers an optional creel tension fine adjustment mechanism. By allowing operators to precisely control sliver tension at the feed rollers, this maintains uniform roving and a balanced rate of sliver draw from the feed cans.

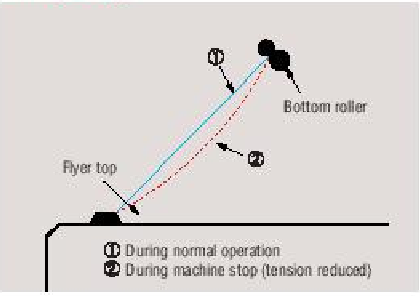
Unique mechanism minimizes roving irregularities

Two separate motors are used to drive drafting and winding operations. This allows winding to be stopped slightly before drafting to provide some slack between front rollers and the flyer top. Thus, by preventing excessive tension at restart, there is no irregularity in roving even for synthetic fibers or coarse count.

Winding and drafting speed



Roving path between front roller and flyer top


①
Bottom roller
②
Flyer top
① During normal operation
② During machine stop (tension reduced)

Simple Operation, High Reliability, and Easy Maintainability

Large color function panel

A 10.5-inch, 2-language color function panel equipped with a Web browser improves interface ability. Connection to an internal or external network is possible for exchange of information or data, thereby expanding the capability of today's spinning mills.

Function panel

Setting functions

- Spinning conditions • Roving bobbin formation
- Flyer speed control (automatic optimum pattern calculation, speed control pattern graph display)
- Stop sequence operation, etc.

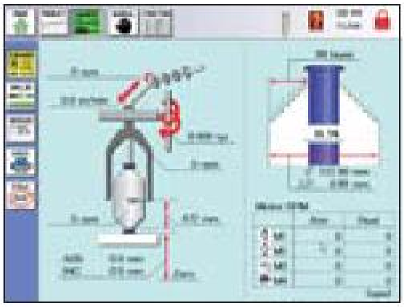
Monitoring functions

- Production volume (shift counter)
- Transition of efficiency for each shift NEW
- History of running conditions for the last 24 hours NEW
- Flyer speed, delivery speed, twists, and time to full bobbin
- Inverter/servo amplifier monitor NEW
- Troubleshooting, history NEW

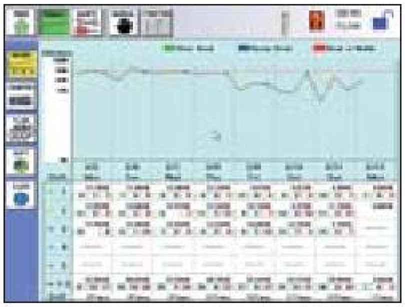
Management functions

- Setting condition memory function NEW
- Memory card NEW
- Maintenance schedule management function NEW

Color LCD touch-screen function panel simplifies input and monitoring



Running condition monitor



Shift report

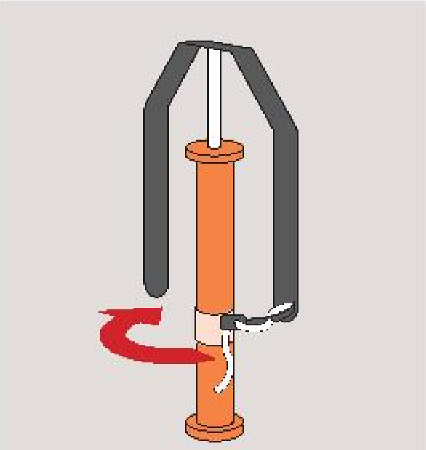
Troubleshooting

TMS (Toyota Monitoring System) OPTION

Advanced mill management has never been easier. TMS, Toyota's original monitoring software, allows you to effectively conduct mill management—including maintenance—right from your office. Simply use a LAN cable to connect multiple Toyota machines to any commercially available PC in the office. That PC can then be used to easily access various kinds of information, such as shift reports, and to directly view the function panels of all connected machines for an accurate assessment of how the machines are operating. What's more, machine setting data can be transferred to another machine without using memory cards—a great way to save time and effort when changing yarn types.

Automatic roving-end positioning device for easy restarting

The need for manual procedures is further reduced through automatic roving-end attachment. When the bobbin rail is raised to the restart position after doffing and new bobbin insertion, the machine restarts in reverse at low speed for a certain period and then switches to normal rotation. Roving ends are automatically positioned and pressed tightly against the bobbins to begin winding.



Roving ends are smoothly wound onto the bobbin

Bobbin collision prevention function

In conventional roving frames, an empty bobbin can occasionally be erroneously set at an angle and can thrust the spindle upwards after doffing, leading to damaged components. The FL200 employs an overload detection function on the servo motors used to raise and lower the bobbin rail to automatically sense this bobbin insertion fault and immediately stop lifting of the bobbin rail. This new mechanism prevents these kinds of accidents from happening.

High-twist roving cutting function

An extra twist is applied locally prior to lowering the full bobbin in order to protect the area where the roving is easily cut. This enables the roving to be cut properly between the presser and the wound bobbin regardless of the type of fiber, enabling automatic doffing.

Machine stop motion

Flyers and bobbins rotate at the same speed without delivery (extra twist applied)

Normal roving resumes, feeding extra twist section inside flyer

Bobbin rail lowers (roving is cut between presser and bobbin)

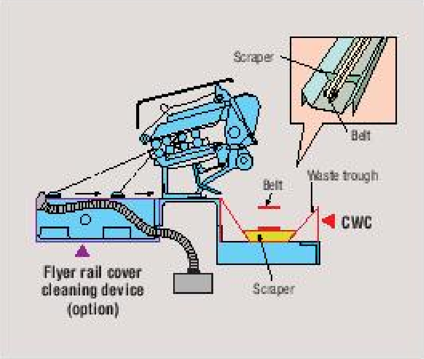
Doffing

Synchronized back-up system for power failure

A back-up power system in the FL200 protects against all kinds of power supply fluctuations, including power failures, enabling the machine to stop while maintaining the synchronization between the spindles and the drafting rollers. In addition, the amount of time back-up power is provided during momentary interruptions to ensure continuous operation has been significantly increased.

Energy-saving Clearer Waste Collector (CWC) prevents fly accumulation (pneuma-less type)

The CWC deposits bottom clearer fly into the waste trough, where a conveyor belt carries it to the waste container at the out end. The pneuma-less suction mechanism uses far less electricity and simplifies maintenance. The elimination of pneumatic noise and microscopic dust improves factory environment.



Stop motion upon roving breakage **OPTION**

A breakage in the middle of the package during operation may cause stray cotton fiber ends to become wound onto adjacent bobbins, causing chain breaks and affecting quality. To prevent this, a phototube with a special circuit detects breakage and immediately stops the machine.

FRD Stationary Doffer for Roving Frames

Toyota's FRD stationary doffer for roving frames has forks that simultaneously hang on the full bobbins and empty bobbins, thus dramatically reducing the stoppage time required during doffing. Downtime is 3.5 minutes, the shortest in the world. Because it's simply designed and independent of the roving frame, maintenance is easy. Toyota guarantees that the FRD will give stable doffing.

Operation Sequence

①

Before doffing

②

Forks move forward

③

Forks grasp full bobbins

④

Forks simultaneously grasp full and empty bobbins

The shortest doffing machine stoppage time in the world

3.5 min.

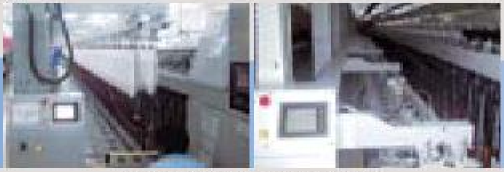
⑤

Empty bobbins are inserted

⑥

Setting of empty bobbins is completed

⑦



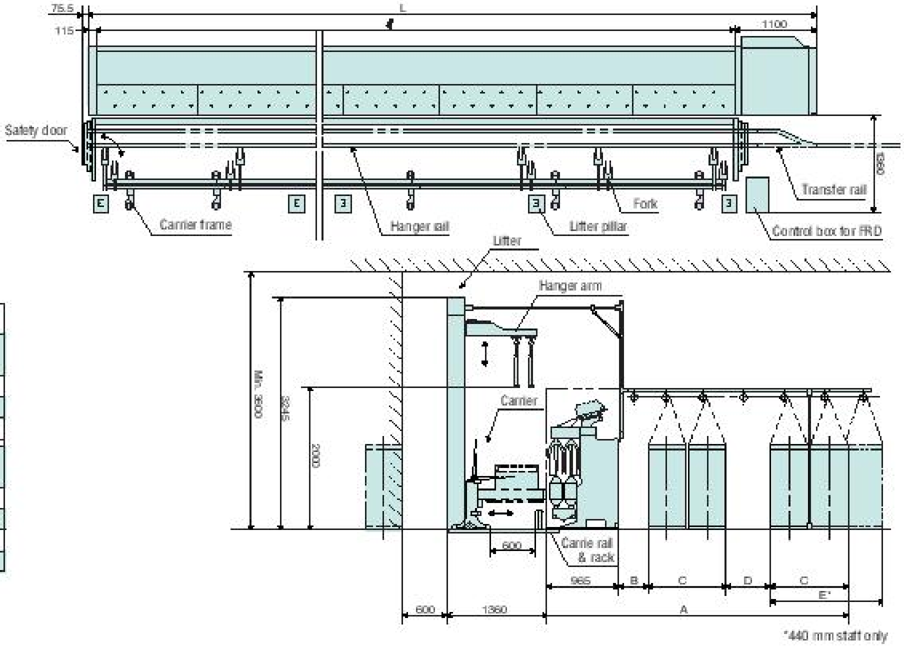
Preparing to raise full bobbins

⑧

Full bobbins are transfered to the ring spinning frame

Floor Plan

	Model FL200 (520 mm staff)	
Dimensions / Number of spindles	ℓ	L (frame length)
120	15,740	16,955
108	14,180	15,395
96	12,620	13,835
Can diameter / Dimensions	508 (20)	508 (20)
A	4,465	4,065
B	400	400
C	1,050	1,050
D	1,000	600


75.5
115
L
ℓ
1100
Safety door
1360
Transfer rail
E
E
3
3
3
Fork
Carrier frame
Hanger rail
Lifter pillar
Control box for FRD
Lifter
Hanger arm
Min. 3600
3245
2000
Carrier
600
Carrie rail & rack
965
B
C
D
C
E*
600
1360
A

*440 mm staff only

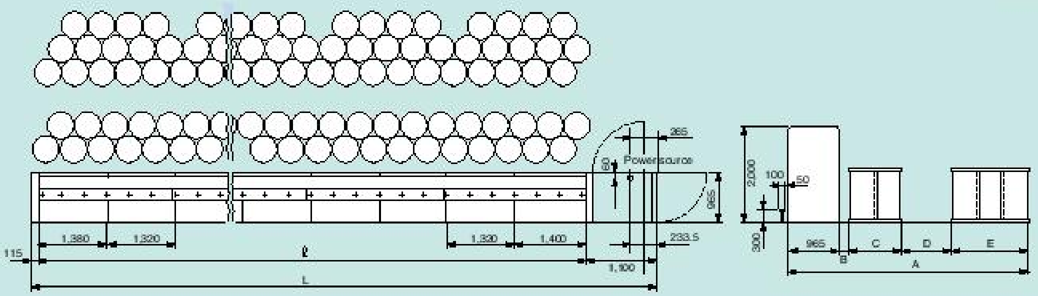
Floor Plan

Model FL200 (440 mm staff)

(Unit: mm)

Number of spindles \ Dimensions	ℓ	L (frame length)
144	15,980	17,195
132	14,660	15,875
120	13,340	14,555
108	12,020	13,235
96	10,700	11,915

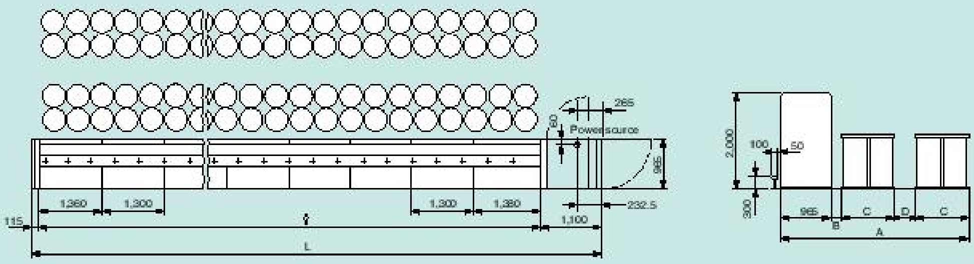
Dimensions \ Can diameter	508 (20)	508 (20)
A	4,805	4,405
B	400	400
C	990	990
D	1,000	600
E	1,450	1,450
Configuration	5-row staggered	



Model FL200 (520 mm staff)

Number of spindles \ Dimensions	ℓ	L (frame length)
140	18,340	19,555
120	15,740	16,955
108	14,180	15,395
96	12,620	13,835

Dimensions \ Can diameter	508 (20)	508 (20)
A	4,465	4,065
B	400	400
C	1,050	1,050
D	1,000	600



Design and specifications are subject to change without prior notice.

Main Specifications

(Unit: mm)

Staple length		22–40 mm	40–51 mm	51–76 mm	44–76 mm*
Drafting system		4-roller (D type)	4-roller (D type)	3-roller	3-roller
Weighting arm	Maker	Texparts	Texparts	Texparts	Texparts
	Type	PK 1500-001938	PK 1500-001938	PK 1500-02	PK 1500-02
Weight (kg/2 spindles)	F	9–12–15	9–12–15	20–25–30	20–25–30
	2	15–20–25	15–20–25	10–15–20	10–15–20
	3	10–15–20	10–15–20	15–20–25	15–20–25
	B	10–15–20	10–15–20	——	——
Cradle type		OH514-110	OH534-110	OH524-110	OH534-110
Cradle radius x width (mm)		34.5 x 40	45.0 x 40	58.0 x 40	45.0 x 40
Bottom roller diameter (mm)	F	28.5	28.5	31.75	31.75
	2	28.5	28.5	28.5 (knurled)	28.5 (knurled)
	3	28.5 (knurled)	28.5 (knurled)	31.75	31.75
	B	28.5	28.5	——	——
Top roller diameter (mm)		28	28	35	35
Roller gauge (mm)	F–2	35– Max.193 (total)	42– Max.193 (total)	73– Max.185 (total)	62– Max.185 (total)
	2–3	4–7	60–	57–	52–
	3–B	45–	49–	——	——
Clearer		Positive intermittent revolving clearer with comb			
Feeding can		Up to 508 mm (20") diameter x 1,150 mm (45") high			
Creel		Positive revolving feed roller with extended creel (single sliver feed system)			
Power required		Main motor: 15kW			
Special devices (included)	High speed	Automatic flyer speed control with inverter			New SL Flyer
	Quality	Automatic tension controller, roving irregularity prevention, roving stop at set length/position, package shoulder collapse prevention, optical electronic roving stop motion, optical electronic sliver stop motion			
	Operation and maintenance	10.5-inch color function panel, bobbin misplacement prevention device, oil bath lubrication for main gearing, automatic grease lubrication for draft gearing, automatic grease supply system for flyer gear, clearer waste collector (pneuma-less type)			
	Automation	Automatic roving-end positioning for machine restart, high-twist roving cutting device			
Options	High speed	Bobbin jumping prevention device			
	Quality	Stop motion upon roving breakage at middle part of package, creel tension fine adjustment mechanism			
	Operation and maintenance	Flyer-rail cover cleaning device, automatic travelling suction cleaner			

* Cradles for 51 to 76 mm length fiber must be ordered separately.

GLOBAL SERVICE NETWORK

Total worldwide customer service

Toyota offers a full range of services, from plant layout consulting to machinery installation and after-sales service. The Toyota Textile Machinery Training Center provides a variety of training courses which precisely match the needs and abilities of individual customers. Toyota also helps train customers' technical engineers from around the world.

1. Plant layout

Before the delivery of machinery, Toyota proposes an installation layout which is designed to optimally suit a customer's plant.

2. Installation

A Toyota expert supervises installation and instructs customers on machine operation.

3. Customer support service

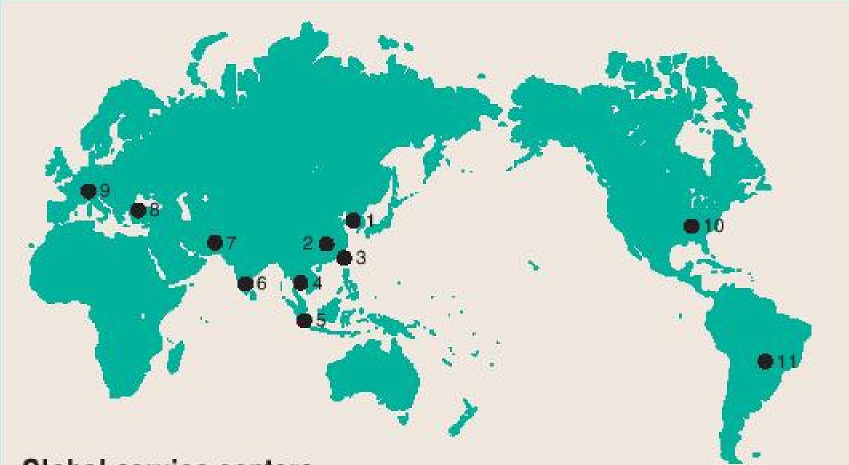
A variety of customer support services are provided, such as supplying spare parts to ensure continuous and smooth operation.

4. Training

Toyota provides a wide range of courses from handling Toyota machinery to management. These substantial courses help customers obtain a level of expertise in both the mechanical knowledge and efficient usage of machinery.

5. Service network

With service centers located around the world, Toyota is able to quickly respond to the needs of local customers.



Global service centers

1. Korea 2. China (Shanghai, Shaoxing, Wujiang, Jinan, Changzhou)
3. Taiwan 4. Thailand 5. Indonesia 6. India 7. Pakistan 8. Turkey
9. Europe (Italy, France, Switzerland) 10. U.S.A. 11. Brazil

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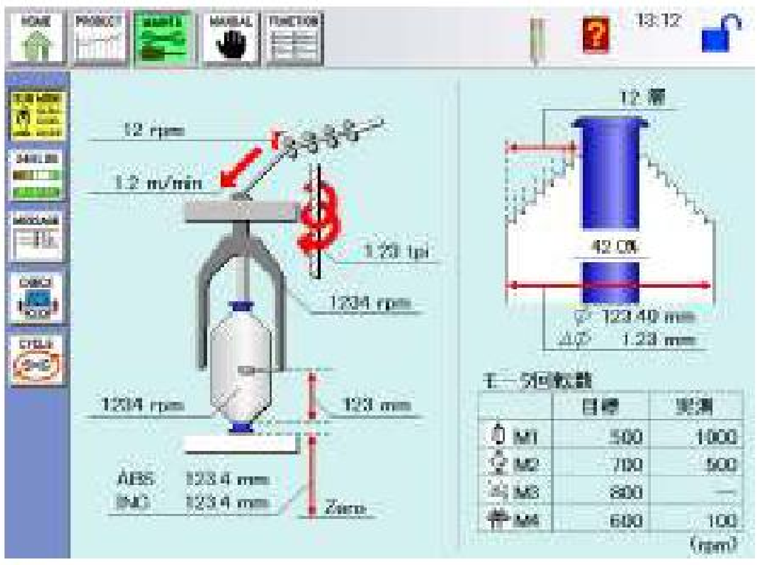
英語
Printed in Japan

Features of FL200

	FL16	FL200	Advantage on FL200	Page No.
440mm Staff and Maximum number of spindles	120	144	–	–
520mm Staff and Maximum number of spindles	120	140	–	–
Mechanical Maximum spindle speed (rpm)	1300	1500	–	–
Driving system	1– main motor with Inverter	4–motor individual system –Main motor with Inverter (For Flyer) –Draft motor (Servo) –Winding motor (Servo) –Lifting motor (Servo)	–Precision control could be realized with individual servo motors. –No winding change pulley necessary –No twist change gear necessary *Draft change gear is required.	FL200 only
Draft part	4 rollers D type draft (Standard)	4 rollers D type draft (Standard)	–	–
Intelligent function 1. Automatic roving tension control	with Cone Drum(Standard)	Without Cone Drum(Standard). With Winding motor (Servo) and TOYOTA original Tension controller.	– Combination of variable Winding motor with Original Tension controller, provide precise and fully automatic tension control without Cone Drum.	4
Intelligent function 2. Automatic stop at set length & position	Not available	With (FL200 standard)	– Microcomputer control makes it possible to stop roving at both a fixed position and specified length.	4
Quality 1. Unique mechanism minimizes roving irregularities	Not available	With (FL200 standard)	– Two separated motor (Draft motor and Winding motor) allows winding to be halted slightly before roving once bobbins are full. And this privide the slack between front rollers and the flyer top. It prevents the excessive tension of roving at restart.	5
Quality 2. Tension controller	Not available	With (FL200 standard)	–CCD sensors mainrains ideal winding tension in 0.1mm level.	6
Quality 3. Creel tension fine adjustment device	Option	With (FL200 standard)	–To prevent the sliver breakage during cans to draft part, precisely control sliver tension at the feed roller.	6
Simple operaton and maintenance 1. Touch Panel	Not available	With 10 inch large Color touch panel	–By inputting basic spinning condition onto the touch penal, CPU automatically sets ideal winding tension and flyer speed change pattern etc. * Basic spinning ①Kind of fiber ②Roving weight ③Full bobbin length ④Twist ⑤Ave.rpm ⑥Pressure winding times	FL200 only
Simple operaton and maintenance 2. Main gearing in oil bath	with (standard)	without (By Timing belt)	–Due to the usage of timing belt, lubrication will not be required for the main gearing.	FL200 only
Simple operaton and maintenance 3. Automatic grease supply for bobbin gearing, flyer gearing, draft gearing	Not available (Manual by hand)	With (FL200 standard)	–To reduce the need for greasing and maintenance procedure, FL200 is available automatic grease lubrication.	8
Simple operaton and maintenance 4. Number of detecting point for sliver breakage	1 point (FL16 standard)	2 points (FL200 standard)	–To check the sliver breakage well, FL200 is available 2 points sliver breakage sensor.	8
Simple operaton and maintenance 5. Stop motion upon roving breakage at mid part of package	Option	With (FL200 standard)	–To check the breakage of roving at middle of the package, photo sensor is available for FL200. After detecting the breakage, machine stops immediately.	8
Others 1. Checking function for the loading of spindle rail	Not available	With (FL200 standard)	–In sometime, mis–setting of the bobbin on the spindle wheel, cause the breakage of Flyer pressor or Lifter luck and etc, due to the irregular loading for the each parts. FL200 apply the Servo Lifting motor, and it make realize and check the loading of the spindle rail, so after detect the irregular loading, machine will stop immediately without brakage of the parts.	FL200 only
Others 2. Smooth roving cutting device	Option	With (FL200 standard)	–Roving cutting function with extra twist for uniform length of Roving edge	FL200 only
Others 3. Smooth restart	Slow start (In case with inverter)	With (FL200 standard) *Main motor and Draft motor is separated	–Reverse rotation of flyer for ensuring roving edge is firmly pressurized on magic tape.	FL200 only
Others 4. Intelligent function for Roving package	Not available	With (FL200 standard)	–FL200 check the volume of increasing the roving always, and doing the fine adjustment to achieve proper roving package. Also collecting the data from each doffing, and storage of these data make stable roving package for every doff	FL200 only

For the normal operation


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
13:12
12 rpm
1.2 m/min
1.23 tpi
1234 rpm
1234 rpm
123 mm
ABS 123.4 mm
INC 123.4 mm
Zero
12 層
42 C%
φ 123.40 mm
Δφ 1.23 mm

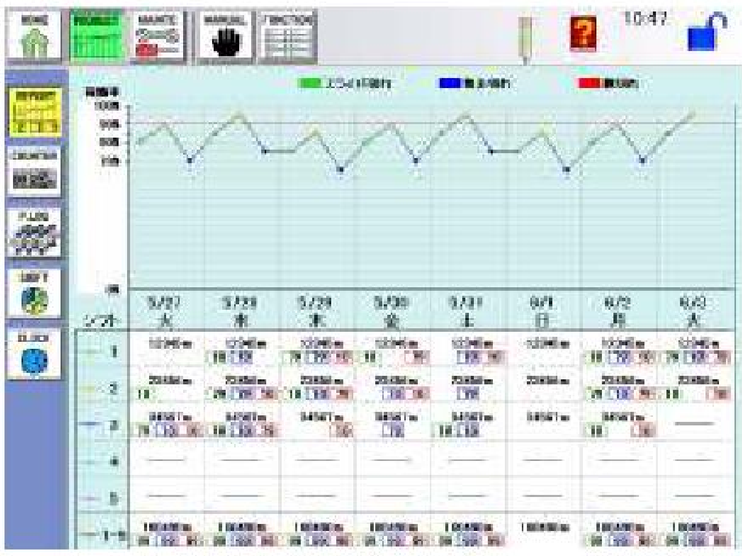
モータ回転数

	目標	実測
M1	500	1000
M2	700	500
M3	800	—
M4	600	100

(rpm)

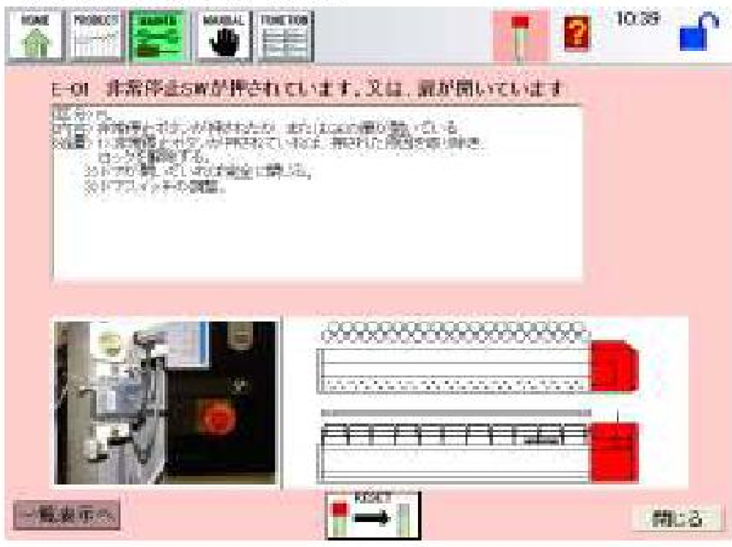
Shift data

Customer can check FL200 machine efficiency in every shift, and also check the factor of stopping.


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
10:47
REPORT
COUNTER
PLUS
SHIFT
CLOCK
5/27
5/28
5/29
5/30
5/31
6/1
6/2
6/3
シフト

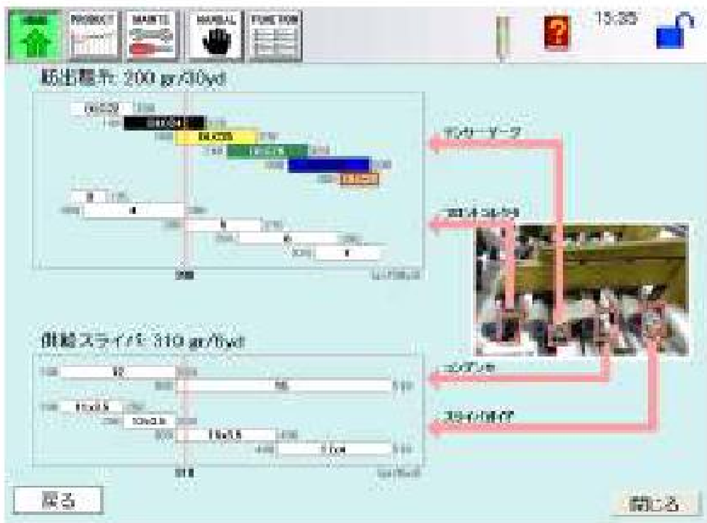
Trouble shooting

In case of machine trouble, color panel display the error details and showing how to solve trouble. Besides, also showing the picture where action should be taken.


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
10:38
一覧表示へ
RESET
閉じる

E-01 非常停止SWが押されています。又は、扉が開いています

Roving assist


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
15:35
紡出番手: 200 gr/30yd
供給スライバ: 310 gr/6yd
戻る
閉じる

Section G.1
Tools and Gauges

G.1.1 Tools & Gauges List G.1-2

[1] Tools & Gauges Necessary for Both Installation and Maintenance G.1-2

[2] Tools & Gauges Necessary for Installation Only G.1-5

[3] Tools & Gauges Necessary for Maintenance Only ... G.1-6

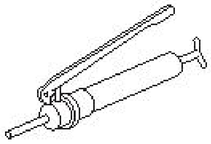
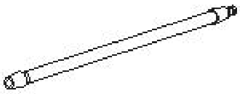
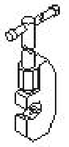
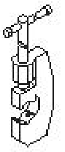
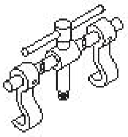
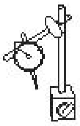
G.1 Tools and Gauges

G.1.1 Tools & Gauges List

[1] Tools & Gauges Necessary for Both Installation and Maintenance

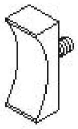
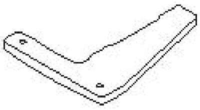
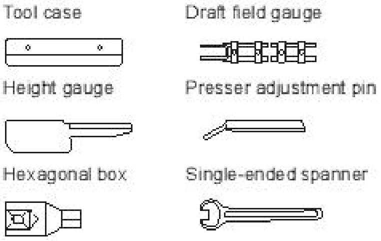
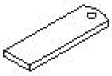
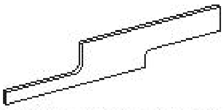
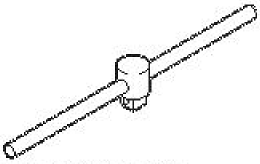
A: Essential to maintenance work
B: Preparation recommended

I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
1	77140-00011  PUMP, GREASE	○	○	1	2	A	I M	
2	77140-00010 (No. 767)  NOZZLE, GREASE PUMP	○	○	1	2	A	I M	
3	R8255-01010-00 (No. 758B)  TOOL, TIGHTENING BOTTOM ROLLER	○	○	2	2	A	I M	For tightening fluted rollers (of 15 to 32 mm dia.)
	F8201-41020-00 (No. 758C)  TOOL, TIGHTENING BOTTOM ROLLER						I M	For tightening fluted rollers (of 30 to 55 mm dia.)
4	R8257-01010-00 (No. 760)  TOOL, STRAIGHTENING BOTTOM ROLLER	○	○	1	1	A	I M	For correcting distorted fluted rollers
5	76201-00009 (No. 783)  GAUGE, DIAL MAGNET BASE	○	○	1	1	A	I M	For correcting distorted fluted rollers

A: Essential to maintenance work
B: Preparation recommended

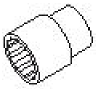
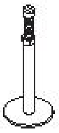
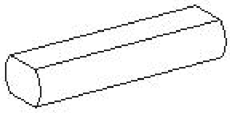
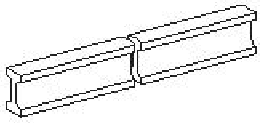
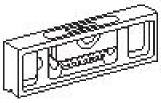
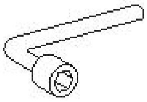
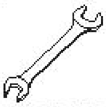
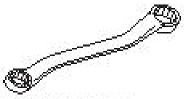
I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
6	R8247-01010-00 (112K-RY5)  POINT, DIAL GAUGE	○	○	1	1	A	I M	For correcting distorted fluted rollers
7	F8201-21011-00 (FL [16]-29 [28.5])  TOOL, ROLLER STAND	○	○	1	1	A	I M	For centering front rollers (of 28.5 mm dia.)
8	F8201-51010-00 (FL00715-ASP1500)  Tool case Draft field gauge Height gauge Presser adjustment pin Hexagonal box Single-ended spanner TOOL, SKF WEIGHTING ARM	○	○	1	2	A	I M	For setting SKF PK1500
9	77134-00005 (No. 759-1)  GAUGE, PLATE ROLLER	○	○	1	1	A	I M	For setting roller gauges (0.5, 1.0, 2.0, 4.0, 8.0, and 16)
10	F8201-11011-00  GAUGE, TIGHTENING FLYER & BOBBIN GEAR	○	○	1	2	A	I M	For positioning flyer & bobbin drive gears
11	77104-00004  ADAPTER, BOX WRENCH	○	○	1	1	A	I M	For tightening flyer nuts

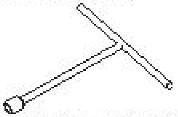
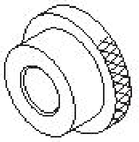
G. TOOLS AND GAUGES

A: Essential to maintenance work
B: Preparation recommended

I: For Installation jobs
M: For Maintenance jobs

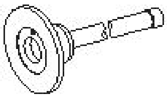
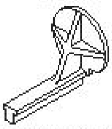
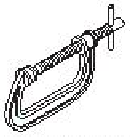
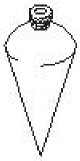
No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
12	77104-32001  SOCKET, BOX (32)	○	○	1	1	A	I M	For tightening flyer nuts
13	F8201-70010-0A  JACK, BOBBIN RAIL	○	○	Depends upon the number of spindles.[*1]		A	I M	[*1]For a stuff of 440 mm: (Number of spindles)/12 + 1 For a stuff of 520 mm: (Number of spindles)/10 + 1
14	F8201-01010-00 (FL-2)  BLOCK, PARALLEL	○	○	2	2	A	I M	For supporting straight edges
15	77133-00006 (No. 720)  TOOL, STRAIGHT EDGE	○	○	1	1	A	I M	For leveling roller beams and bobbin rails
16	77133-00007 (No. 750)  LEVEL	○	○	2	2	A	I M	Level
17	77104-19004 (No. 118M [N])  WRENCH, BOXED L TYPE (19)	○	○	1	1	A	I M	For tightening roller stands
18	77101-32001 (No. 63)  SPANNER, DOUBLE END (32 × 36)	○	○	1	1	A	I M	For tightening bobbin gears and studs
19	77106-22001  WRENCH, BOBBIN RAIL	○	○	1	1	A	I M	For tightening bobbin rails

A: Essential to maintenance work
B: Preparation recommended
I: For Installation jobs
M: For Maintenance jobs

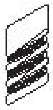
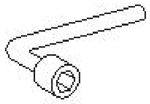
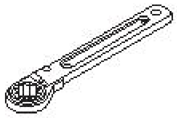
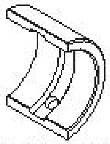
No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
20	77104-12001 (No. 207)  WRENCH, BOXED T TYPE (12.7)	○		1	1	A	I M	For tightening cone drums
21	F8211-04010-00  TOOL, CENTERING CONE DRUM	○		1	1	A	I M	For centering cone drums

[2] Tools & Gauges Necessary for Installation Only

A: Essential to maintenance work
B: Preparation recommended
I: For Installation jobs
M: For Maintenance jobs

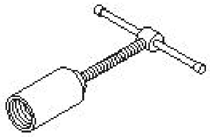
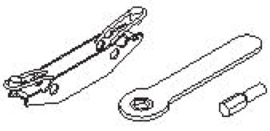
No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
1	F8201-17010-00 (FL-13 [6])  TOOL, ALIGNING SHAFT	○	○	1	1	A	I	For positioning flyer rails
2	F8201-04010-00 (FL-3)  PLATE, LEVEL SPRING PIECE	○	○	2	2	A	I	For uprighting lifter slide grooves on the spring pieces
3	77135-00014  VICE, SQUARE SPRING PIECE	○	○	2	2	A	I	Vice for securing level spring piece plates
4	77133-00012  BOB, PLUMB	○	○	2	2	A	I	For checking the parallelism between the reference line and roller beam

A: Essential to maintenance work
B: Preparation recommended
I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	Formore than 5 units			
5	77133-00018  TOOL, LEVELING STRING	○	○	1	1	A	I	For centering roving frames (To be used with a plumb bob.)
6	77104-17002 (No. 133)  WRENCH, BOXED L TYPE (17)	○	○	1	1	A	I	For tightening nuts on back top brackets
7	77108-00003  WRENCH, QUICK RATCHET (24)		○	1	1	A	I	For tightening balance spring nuts
8	F8221-08010-00  GAUGE, FRONT ROLLER PINION		○	1	1	B	I	Second roller drive specification

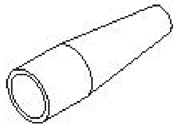
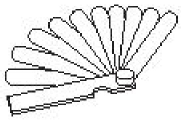
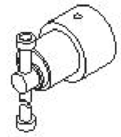
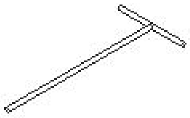
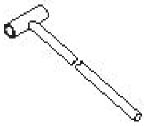
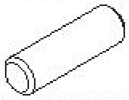
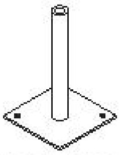
[3] Tools & Gauges Necessary for Maintenance Only

A: Essential to maintenance work
B: Preparation recommended
I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	Formore than 5 units			
1	F8201-34010-00 (FL-20)  TOOL, FLYER BEARING HOUSING	○	○	1	1	A	M	For disassembling flyer bearing housings
2	F8201-25010-00 (FL-30)  TOOL, TIGHTENING STEEL BAND	○	○	1	1	A	M	For tightening rubber boots for universal joints

A: Essential to maintenance work
B: Preparation recommended

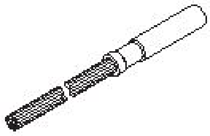
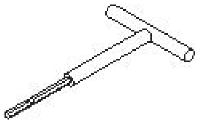
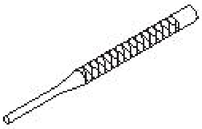
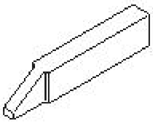
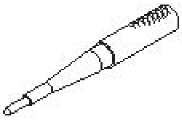
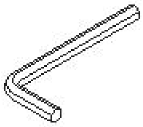
I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
3	F8201-31010-00 (FL-31)  TOOL, RUBBER BOOT INSERT	○	○	1	1	A	M	For inserting rubber boots for universal joints
4	77134-00004 (No. 756)  GAUGE, THICKNESS	○	○	1	1	B	M	For checking clearances
5	F8211-30010-00 (FL-27A)  TOOL, TAPER KEY	○		1	1	A	M	Pull-out tool for headed taper keys
6	77112-08001 (BS-3)  WRENCH, DRAFT GEARING	○	○	1	1	B	M	For tightening hexagon socket head bolts on draft gearings
7	F8211-45010-00 (FL-42)  TOOL, FLYER SPINDLE	○	○	1	1	B	M	For correcting flyer spindles
8	F8211-43010-00 (FL-41)  TOOL, BEARING FLYER HOUSING	○	○	1	1	B	M	For driving in flyer housings
9	F8211-40010-00 (FL-40)  TOOL, BEARING STAND FLYER HOUSING	○	○	1	1	B	M	For driving in flyer housings

G. TOOLS AND GAUGES

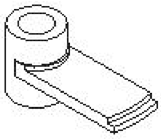
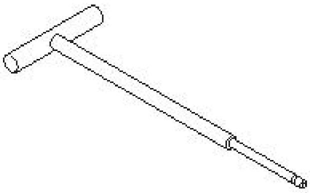
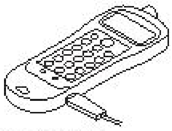
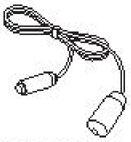
A: Essential to maintenance work
B: Preparation recommended

I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	Formore than 5 units			
10	F8201-57010-00 (FL-37)  TOOL, FLYER CLEANING TYPE SLITLESS	○	○	5	5	B	M	For cleaning pipe flyers
11	F8201-61010-00 (FL-38)  WRENCH, HEXAGON SOCKET SCREW	○	○	1	1	A	M	For tightening pins which support presser tops
12	F8211-07020-00  TOOL, ASSEMBLING PRESSER PIN	○		1	2	A	M	For extracting the lower support pin for the presser
13	F8211-11010-00 (FL-22)  TOOL, DRIVING PRESSER PIN	○		1	2	A	M	For driving in the lower support pin for the presser
14	F8211-17010-00 (FL-24)  TOOL, TEMPORARILY INSTALLING PRESSER	○	○	1	1	B	M	For installing pressers temporarily
15	77111-04001 (No. 306)  WRENCH, HEXAGON SOCKET BOLT		○	1	2	A	M	For installing/removing pressers

A: Essential to maintenance work
B: Preparation recommended

I: For Installation jobs
M: For Maintenance jobs

No.	Parts Number (Old number) Parts Name	Compatible with		Quantity		Degree of Necessity	Job Type	Remarks
		FL16	FL200	For 1 to 5 units	For more than 5 units			
16	F8211-20010-00 (FL-25)  GAUGE-COMPL, CHECK PRESSER MOVING DISTANCE	○		1	1	B	M	For checking the presser moving distance
17	77112-05004  WRENCH, HEXAGON		○	1	1	B	M	For tightening the coupling in the second roller drive specification
18	77135-00026-00  TOOL BELT TENSION		○	1	1	B	M	
19	77135-00027-00  SENSOR, BELT TENSION		○	1	1	B	M	For making measurements under noisy conditions it is necessary to use this as a set with the tool listed above.

FL 200

ROVING FRAME
INSTRUCTION MANUAL

ROVING FRAME INSTRUCTION MANUAL

Model FL200

(FIRST EDITION)

Thank you for purchasing the FL200 Roving Frame.

This instruction manual describes the correct installation, operating principles, function, adjustment, and maintenance of the FL200 motions, all of which should be familiar to all personnel concerned.

Before operating, adjusting, or maintaining the FL200, be sure to read this manual carefully to understand the FL200.

If you have any questions concerning the machine, please contact us at the following locations:

HEAD OFFICE: **TEXTILE MACHINERY SERVICE DIVISION,**
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Specifications, operating instructions, and dimensions in this manual are subject to change for improvements without prior notice.

TOYOTA shall take no responsibility for loss, damage, expense or claims for bodily injury or property damage arising from incorrect usage which is not in accordance with the instructions given in this manual.

In no event will TOYOTA be liable for products resulting from the use of this machine.

JUNE, 2007 Ver. 1.00

ABOUT THE FL200 INSTRUCTION MANUAL

The FL200 roving frame instruction manual consists of 11 sections as listed below.

Section S. SAFE WORK
Section 1. FL CONDITION SETTING
Section 2. INSTALLATION
Section 3. ADJUSTMENT
Section 4. OPERATION
Section 5. OPERATION PANEL
Section 6. ROVING
Section 7. INSTRUMENTATION
Section 8. TROUBLESHOOTING
Section M. LUBRICATION, MAINTENANCE, AND DISASSEMBLY/REASSEMBLY/ADJUSTMENT
Section G. TOOLS AND GAUGES

- This manual also covers some options and selections available with the FL200; it is not edited for your machine specifications only.

  If any descriptions relating to your specifications are missing, contact TOYOTA.

- Values given in this manual are reference values; they are not assured values.

- This manual does not cover the yarn preparation, machine installation or anything else already sent to you as the "Installation Guide."

- For the inverter and cleaning unit, refer to the instruction manual provided by each manufacturer.

- Each chapter gives the outline of the mechanism and its sketch, which are followed by the details consisting of description and photos/sketches.

(1) **⚠ WARNING**

The **⚠ WARNING** symbol is used in this manual, alerting you to a situation that might cause serious injury or death to the operator if he or she does not follow the instructions in this manual necessary to avoid any dangers in the machinery.

(2) **⚠ CAUTION**

The **⚠ CAUTION** symbol is used in this manual, alerting you to a situation that might cause minor injury to the operator if he or she does not follow the instructions in this manual necessary to avoid any dangers in the machinery.

(3) NOTE

The **NOTE** mark is used here, alerting you to possible substantial property damage if the operator fails to follow the instructions in this manual.

- Abbreviations and Notations

This manual uses the following notations for clarity purposes.

• Roving frame, model FL200	FL
• Gear-end frame of FL200	GE
• Out-end frame of FL200	OE

Section M.1
Lubrication

M.1.1 Preparation and Lubricant Storage M.1-2

M.1.2 Types of Lubricants and Their Properties M.1-3

- [1] Lubricant types, lubricant symbols, and major lubricating points M.1-3
- [2] Properties of grease M.1-4
- [3] Properties of oil M.1-5

M.1.3 Lubricating Points and Intervals M.1-6

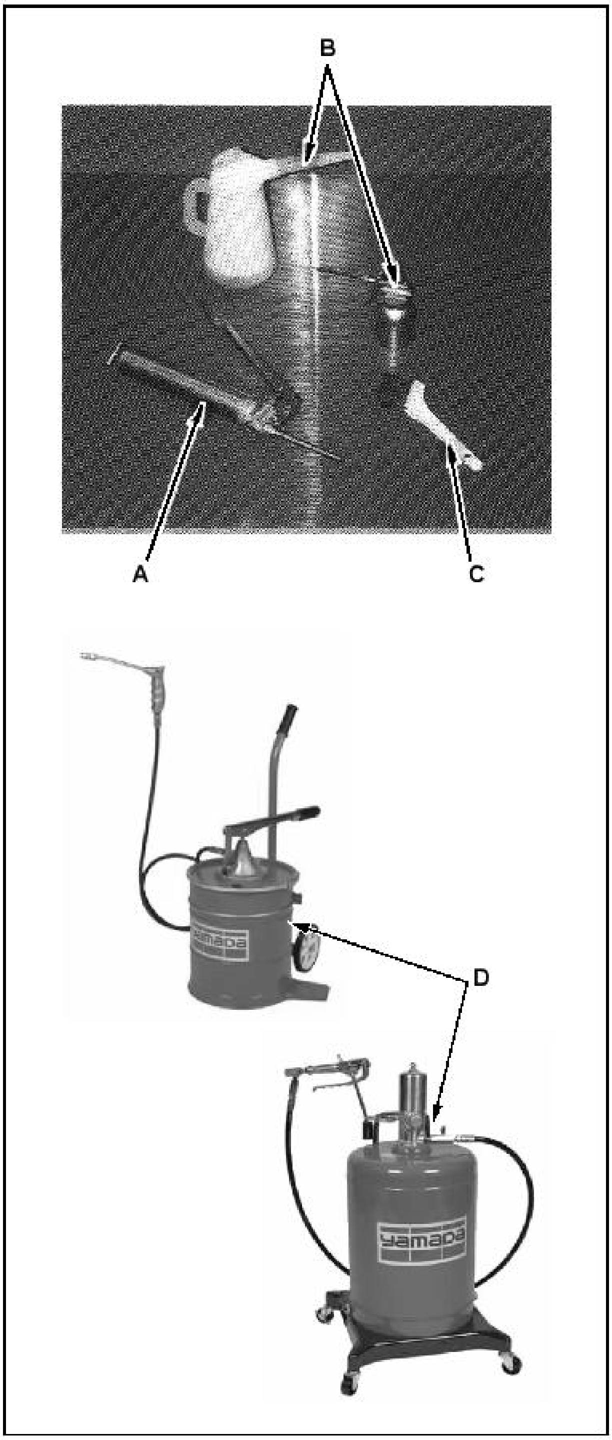
- [1] At intervals of 667-3333 hours (For FLs having 120 spindles) M.1-6
- [2] Weekly M.1-8
- [3] Every 2 weeks M.1-9
- [4] Every 1.5 months (6 weeks) M.1-10
- [5] Every 3 months (12 weeks) M.1-11
- [6] Semiyearly (Every 24 weeks) M.1-17
- [7] Yearly (Every 48 weeks) M.1-17
- [8] At the end of the boot service life M.1-18

M.1.4 Lubricating Records M.1-19

M.1 Lubrication

Appropriate lubrication is very important not only for extending machine life and saving driving power and maintenance cost, but also for maintaining excellent productivity and quality of roving.

The following gives the type of recommended lubricants, properties, lubricating points, and lubrication intervals. When supplying lubricant, it is recommended that the same brand as the previous one be used.



M.1.1 Preparation and Lubricant Storage

(1) Prepare the following lubrication tools and store them in a ready-to-use state.

• Grease gun **A**	(Tool No. 77140-00004)
• Oiler **B**	(Commercially available)
• Brush **C**	(Commercially available)
• Grease pump **D**	
• Funnel	(Commercially available)
• Drain container	(Commercially available)

(2) Before lubrication, make sure that no air is entrapped inside the grease gun.
Air entrapped inside the gun will prevent correct greasing.

Periodically check the feeding amount of grease.

(3) Before lubrication, check that the grease nipple of each lubricating point is not damaged or broken.

(4) Lubricant storing notes

1) Seal up the lubricant containers and place them in a well-ventilated room separated from the machine rooms.

2) Avoid storing lubricants for more than one year, since even high-quality lubricants may deteriorate as time passes.

3) Never mix different brands of grease or oil.

M.1.2 Types of Lubricants and Their Properties

[1] Lubricant types, lubricant symbols, and major lubricating points

Type	Symbols	Lublicating points	Japanese products, Standard products	ExxonMobil Mobil Brand	ExxonMobil Esso (Exxon) Brand	Chevron Texaco (CALTEX)	Sell	NOK KLUBER	DOW CORNING	BP	Castrol	Other manufacturer
Grease	A	Bearings (Ball bearings, roller bearings, and needle bearings)	**Kyodo Yushi** Unilube No.2	Mobilux EP 2 or Mobilgrease XHP 222	Beacon EP 2	Multifak No.2	Alvania grease S2	Centoplex 2EP		BP Energrease MM-EP2	Longtime PD2	
	C	Flyer bobbins, and driving gears	**Kyodo Yushi** Unilube DL No.1	Mobilux EP 1	Beacon EP 1						Longtime PD1	
	D	Open gears	**Kyodo Yushi** Unilube DL No.2 **Nippon Oil** Epinoc grease AP(N)2 **Idemitsu** Daphne Eponex EP No.2	Mobilux EP 2	Beacon EP 2	Multifak EP2	Alvania EPgrease 2	Centoplex 2EP		BP Energrease MM-EP2	Longtime PD 2	
	J	Lifters and slides						Unimoly GL82	Molykote BR2 Plus			
	K	Bottom rollers and neck bearings	**Kyodo Yushi** Powerlite HT	Mobilgrease XHP 222		Multifak AFB2		Staburags NBU12/ 300KP				
	L	Universal joints	**Kyodo Yushi** Molylex No.2					Unimoly Plus	Molykote EP grease			
	M	Couplings for flyer shafts and bobbin shafts	**SUMI-KOU** Moly Paste 500					Unimoly Plus	Molykote GN paste			
	P	Winding motors and gear boxes						Unimoly Plus	Molykote GN paste			
Oil	B	Metal plates	JIS No.2 machine oil	Mobil Vactra Oil No.2	Teresstic 68			Crucolan 68				
	E	Differential gear box		Mobilgear 600xp150	Spartan EP150		Omara Oil 150	Lamora D150 Syntheso HT150		BP Energol GR-XP150	Alpha SP 150	
	F	Lifting gear boxes	**Idemitsu Oil** Alfa Worm 460 **Nippon Oil** Bonnock AX460	Mobil SHC 632 SHC 634						Alphasyn EP 320 EP 460	Tribol 800/320 800/460	
	G	Chains	JIS No.4 motor oil	Mobilgear 600xp150	Millcot K220	Regal R&O	Tellus Oil 68	Structovis FHD				

[2] Properties of grease

Manufacturers	Product Names	Symbols	Soap radical	Penetration	Dropping Point (°C)
Kyodo Yushi	Unilube No.2	A	Li	265 to 295	195
	Unilube DL No.1	C	Li	325	190
	Unilube DL No.2	D	Li	280	190
	Powerlite HT	K	Ca complex	265 to 295	260
	Molylex No.2	L	Li	265 to 295	195
Idemitsu Kosan	Daphne Eponex EP No.2	D	Li	276	197
Nippon OIL	Epinoc AP(N)2	D	Li	275	203
SUMI-KOU	Moly Paste 500	M	(MoS2)	280	> 70
ExxonMobil Mobil Brand	Mobilux EP 2	A	Li	265 to 295	202
	Mobilux EP 1	C	Li	310 to 340	198
	Mobilgrease XHP 222	D, K	Li Complex	265 to 295	> 260
	Mobilux EP 023	N	Li	445 to 475	NA
ExxonMobil Esso (Exxon) Brand	Beacon EP2	A	Li	265 to 295	195
	Beacon EP1	C	Li	310 to 340	192
Chevron Texaco (CALTEX)	Multifak No.2	A	Li	280	195
	Multifak EP 2	D	Li	280	195
	Multifak AFB2	K	Li	280	195
Shell	Alvania Grease S2	A	Li	275	85
	Alvania EP Grease 2	D	Li	284	184
	Alvania EP Grease R000	N	Li	450	166
NOK KLUBER	Centoplex 2EP	A, D	Li	265 to 295	> 190
	Unimoly GL82	J	Li	265 to 295	> 190
	Staburags NBU12/300KP	K		285 to 315	> 220
	Unimoly Plus	L, M	(MoS2)	270 to 300	> 170
DOW CORNING	Molykote BR2 Plus	J	Li (MoS2)	265 to 295	179 to 182
	Molykote EP Grease	L	Li (MoS2)	285	182
	Molykote Gn Paste	M	(MoS2)	300	200
BP	BP Energrease MM-EP2	A, D	Li	265 to 295	175
Castrol	Longtime PD2	A, D	Li	265 to 295	255
	Longtime PD1	C	Li	310 to 340	> 260

[3] Properties of oil

Manufacturers	Product Names	Symbols	Viscosity (mm^2/s)		Viscosity index	Flash point (°C)	Pour point (°C)
			40°C	100°C			
ExxonMobil Mobil Brand	Vactra Oil No.2	B	66.8	9.33	118	224	–22.5
	Mobilgear 600xp 150	E/G	150	14.7	97	230	–24
	Mobil SHC 632	F	326	38.6	169	250	–39
	Mobil SHC 634	F	430	48.5	173	262	–42
ExxonMobil Esso (Exxon) Brand	Teresstic 68	B	63.2	8.5	106	238	–15
	Spartan EP 150	E	144	14.8	103	242	–27.5
	Millcot K 220	G	227	20.7	107	272	–12.5
Chevron Texaco	Regal R&O	G	30.6	5.3	102	212	–9
Shell	Tellus Oil 68	G	68	8.9	103	248	–32.5
	Omara Oil 150	E	150	14.8	97	248	–20
NOK KLUBER	Crucolan 68	B	68	8.8	90	> 200	< –10
	Lamora D150	E	150	15	100	> 240	< –20
	Syntheso HT150	E	150	30	220	280	–45
	Structovis FHD	G	150	15	100	250	< –12
BP	BP Energol GR-XP150	E	149	14.5	96	238	–12
	Alphasyn EP 320	F	320	33	140	230	–36
	Alphasyn EP 460	F	460	45	140	230	–36
Castrol	Alpha SP 150	E	150	18	140	220	–48
	Tribol 800/320	F	317	24	253	282	–30
	Tribol 800/460	F	467	31	254	282	–30
Idemitsu Oil	Alfa Worm 460	F	462.1	50.0	170	232	–40
Nippon Oil	Bonnock AX460	F	435	48.9	173	284	< –45

M.1.3 Lubricating Points and Intervals

DON'T TURN THE SWITCH ON

⚠ CAUTION

> Be sure to observe the rules given in Section S.1, Subsection S.1.3, "Rules for Maintenance."

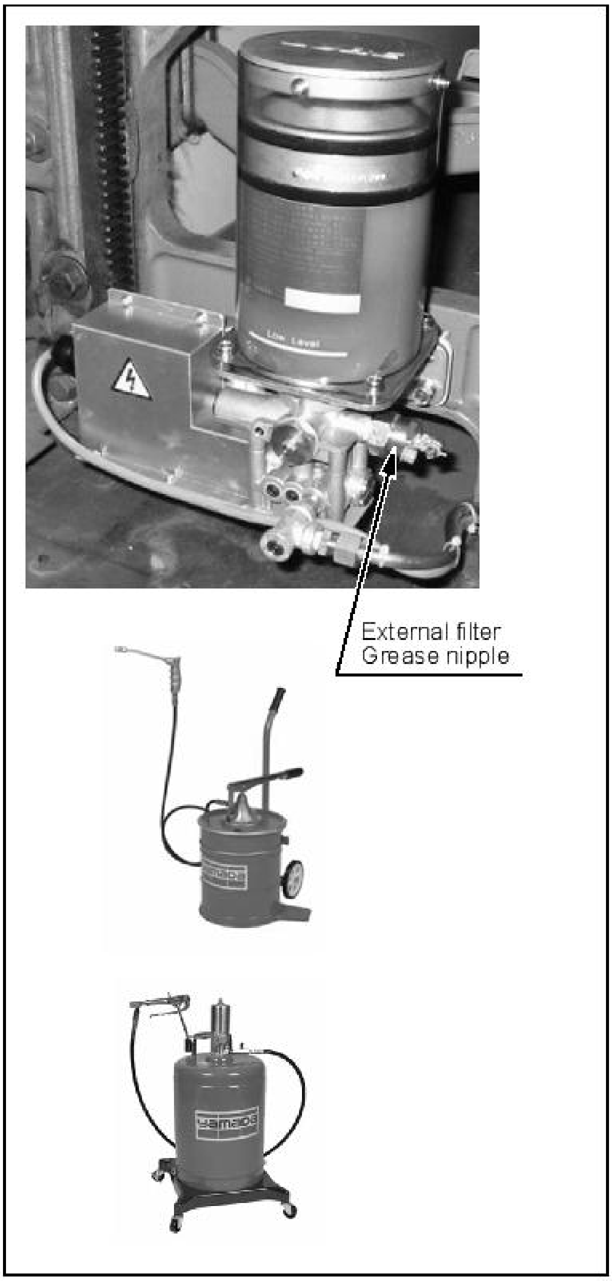
[1] At intervals of 667-3333 hours (For FLs having 120 spindles)

- **Lubricator tank**

> Lubricating tools: Portable grease pump
> Lubricant: Lubricant **C**

Refill grease into the lubricator tank through the grease nipple provided at the bottom, using any of the portable grease pumps as shown at left.

NOTE: Do not refill grease from the top of the tank to prevent an empty stroke of the lubricator.

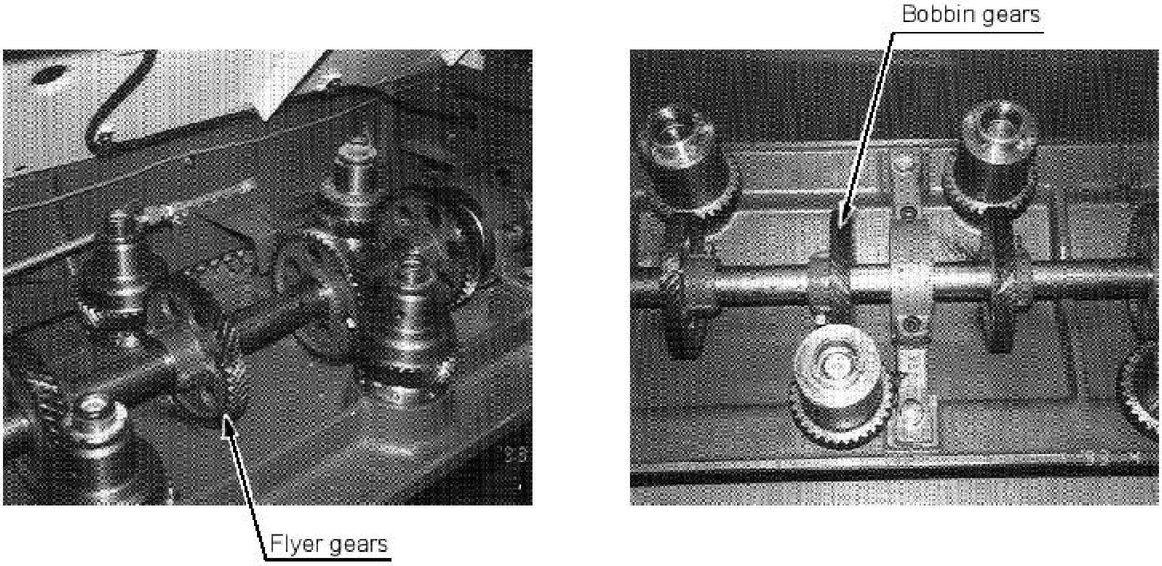


(For 120-spindle FLs)

Max. flyer speed	Schedule for manual refill of grease to the lubricator tank	Automatic lubrication interval*1
1400 to 1500 rpm	667 H	24 H
1300 to 1399 rpm	833 H	30 H
1200 to 1299 rpm	1667 H	60 H
1100 to 1199 rpm	2500 H	90 H
1000 to 1099 rpm	3333 H	120 H

*1 To be set from the operation panel
For the automatic lubricating points, see the next page.

■ Automatic Lubricating Points by Lubricator

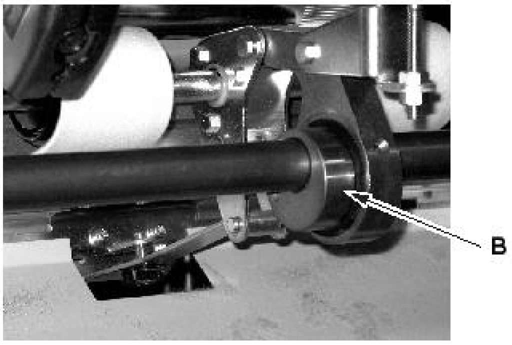

Bobbin gears
Flyer gears

[2] Weekly

- ■ **Metal section of the oscillating rod**

Lubrication tools:	Oiler (small)
Lubricant:	Lubricant **B**

Metal section of the oscillating rod
(Apply a few drops of lubricant **B**.)

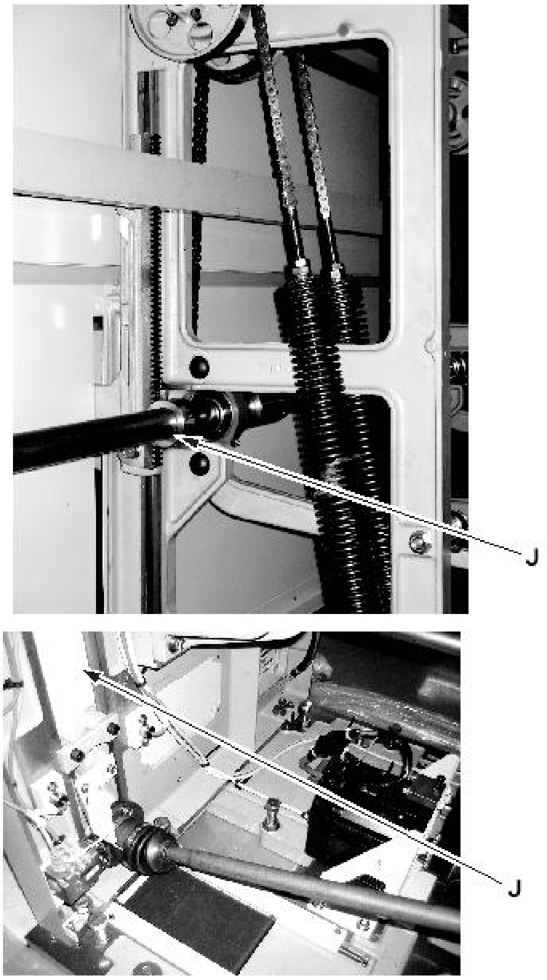


- ■ **Lifter rack**
- ■ **Lifter slide**

Lubrication tools:	Brush
Lubricant:	Lubricant **J**

Lifter rack and slide at the intermediate section (Lubricant **J**)

Slide in the GE head (Lubricant **J**)

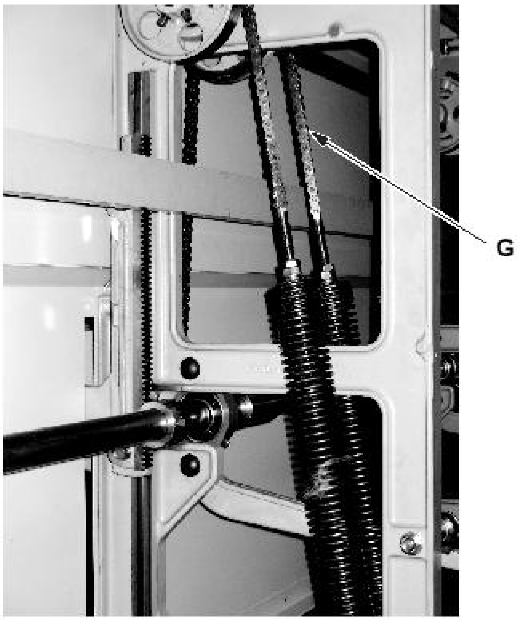


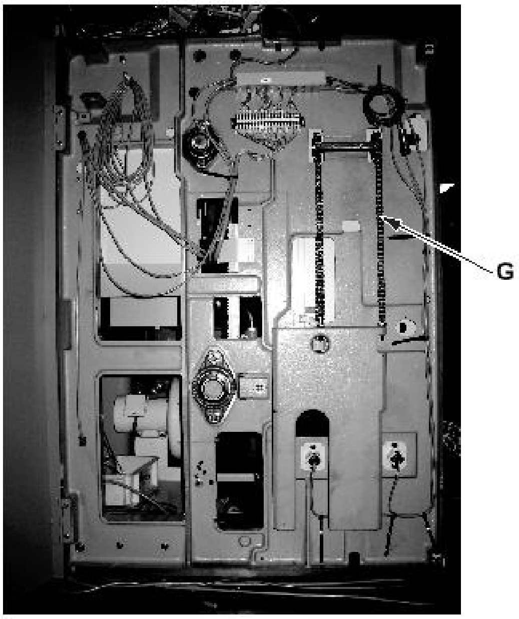
[3] Every 2 weeks

- **Balance spring chain**
- **OE balance weight chain**

Lubrication tools: Brush

Lubricant: Lubricant **G**





Balance spring chain at the intermediate section (Lubricant **G**)

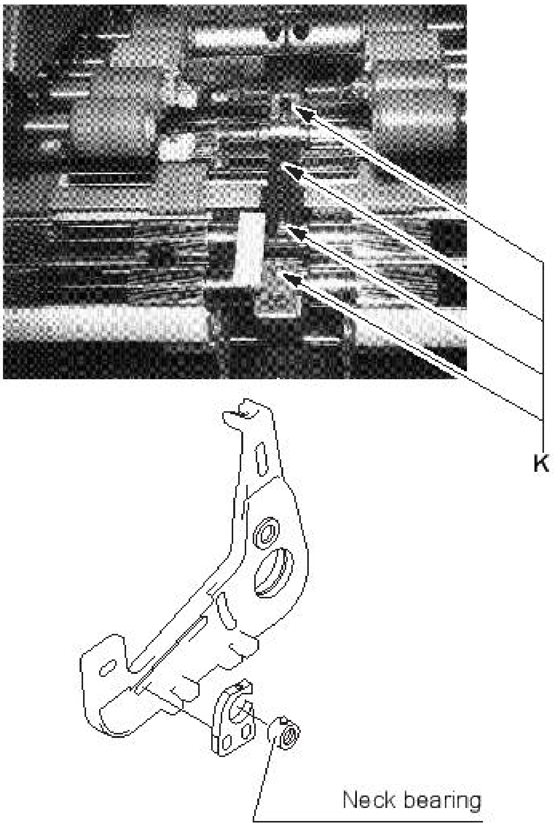
Balance weight chain at the OE (Lubricant **G**)

[4] Every 1.5 months (6 weeks)

■ Bottom roller neck bearings

Lubrication tools:	Grease gun (Tool No. 77140-00004)
Lubricant:	Lubricant **K**

All the roller neck bearings
(Apply lubricant **K** through the nipples so that grease slightly comes out from the sides of those bearings.)

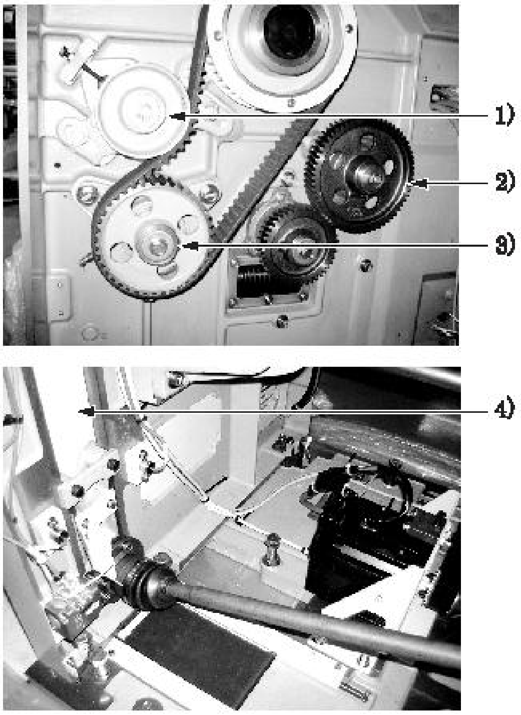


(Inside the GE head draft gearing)

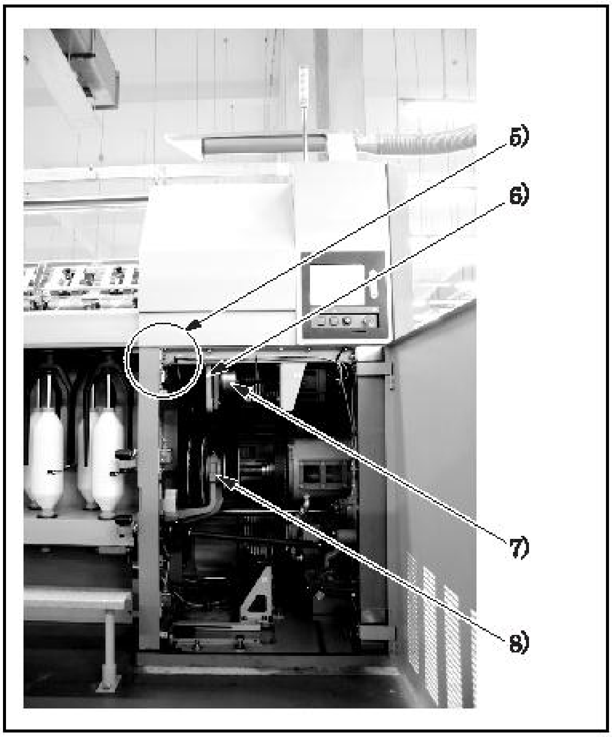
[5] Every 3 months (12 weeks)

- **All the lubrication points within the GE head.**

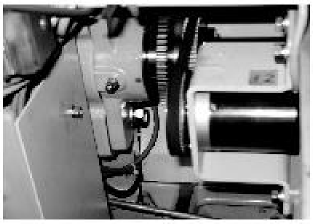
Lubrication tools:	Grease gun Tool No. 77140-00004, (Brush for coating)
Lubricant:	Lubricant **A**, (Lubricant **M**)



1) Bobbin drive tension pulley bracket
2) Lifter gear
3) Bobbin drive bracket
4) Bobbin rail slide



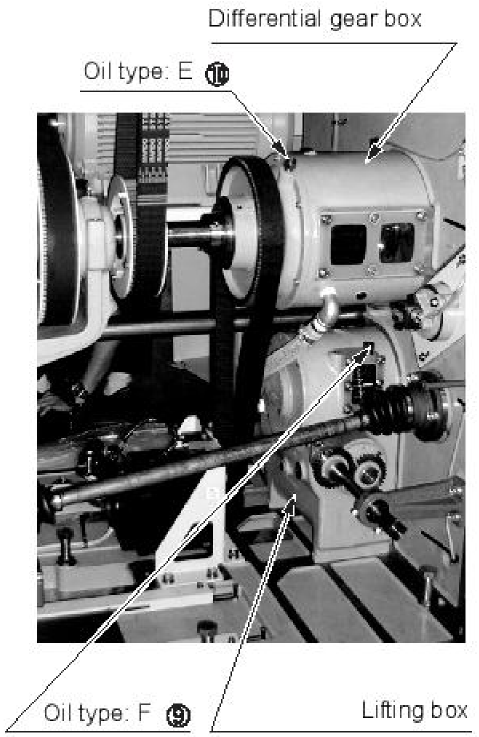
5) Flyer drive bracket



6) Flyer drive shaft bracket

7) Flyer drive tension pulley

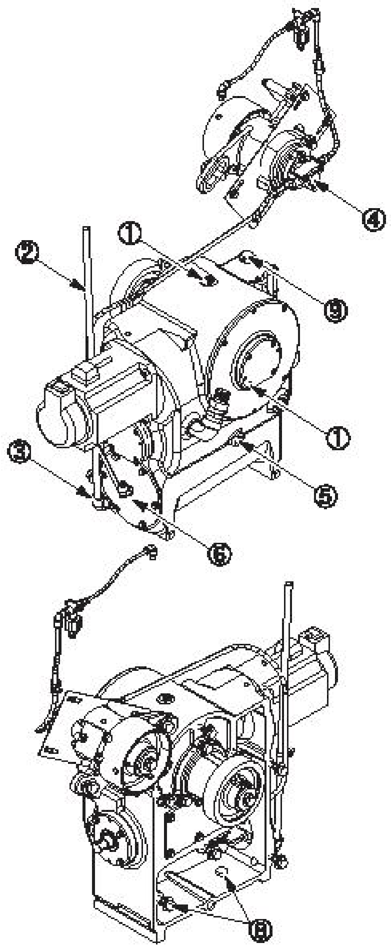
8) Pedestal



■ Differential gear box/Lifting gear box

Lubrication tools:	Oiler, funnel, and drain container
Lubricant:	Lubricant **E, F**

NOTE: The oil in new machines will become dirty due to the wear on the gears during initial operation. Therefore make the first oil change after about 200 hours of operation.



(1) Method of draining the oil

1) Rotate the joint ③ of the oil tube ② 90 degrees and put the tip into a container for the waste oil. Then drain the oil.

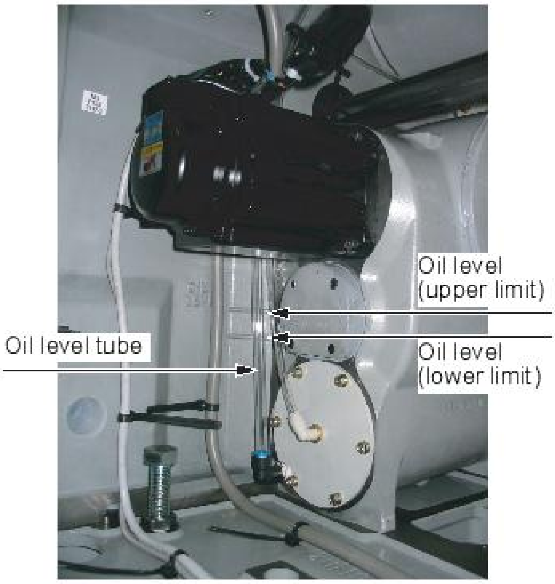
2) It is possible to speed up the oil draining process by detaching the oil tube that runs between the lifting gear box ① and the oil pump ④ on the oil pump side and then blowing compressed air into it.

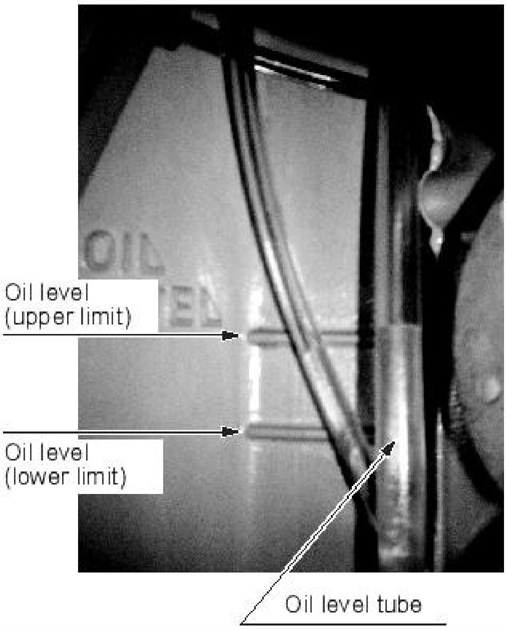
3) Next, place a small waste oil container under the drain plug ⑤. Then remove the drain plug and drain out the oil.

4) Finally, remove the cap ⑥ and clean the oil filters inside the lifting box (M6, six places).

5) Inside the lifting gear box there are two magnets ⑧. Remove both of these and clean them.

(2) Method of refilling the oil
Refill oil to the lifting gear box ① after removing the air bleeding plug ⑨, and to the differential box removing the air vent ⑩.


Oil level
(upper limit)
Oil level tube
Oil level
(lower limit)

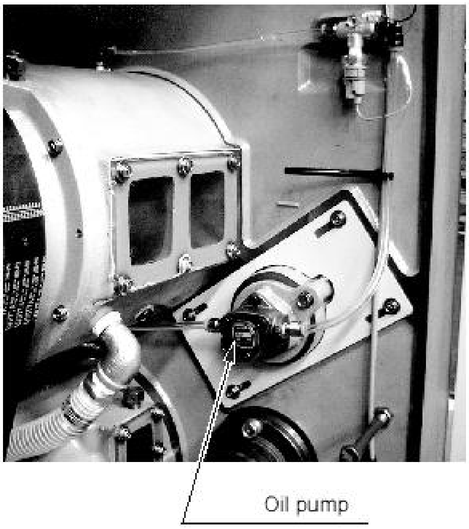

Oil level
(upper limit)
Oil level
(lower limit)
Oil level tube

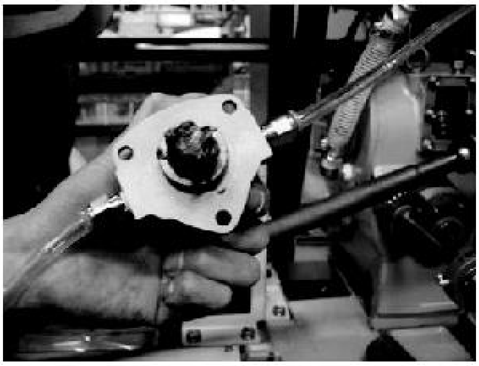
On the removable plate of the gear end frame's lifting gear box there are two oil level lines. Refill oil up to the lower of these two lines. After operation has begun check to see that the oil in each section is proper and that the oil level is between the upper and lower oil level lines.

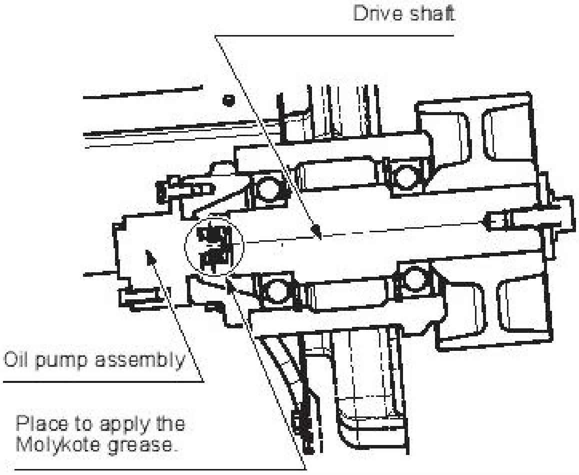
Oil pump axis

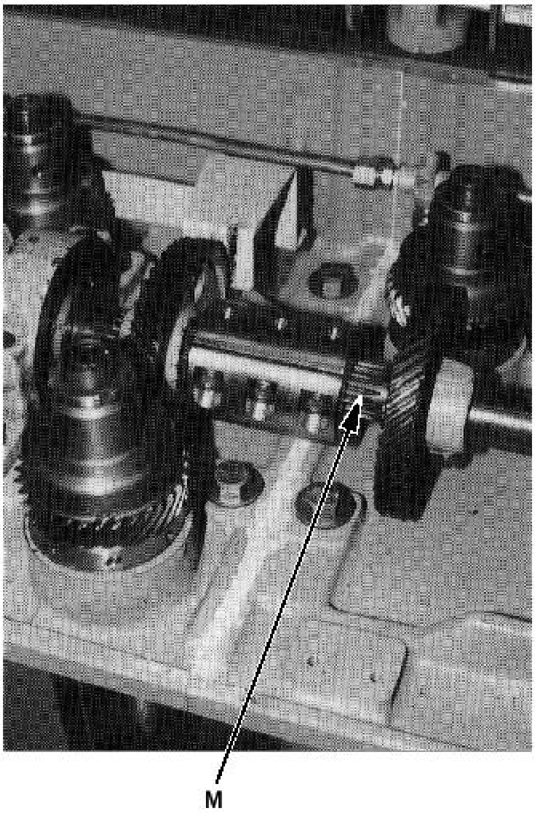
Lubrication tools:	Oil pump
Lubricant:	Lubricant **E**

In order to prevent wear due to micro-vibrations, apply Molykote grease on the pump assembly side.






Drive shaft
Oil pump assembly
Place to apply the Molykote grease.



■ Spline couplings on the flyer shaft and bobbin shaft

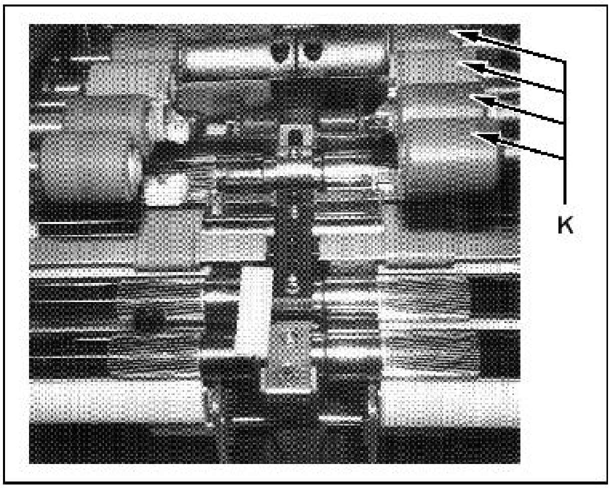
Lubrication tools:	Brush
Lubricant:	Lubricant **M**

Shift the spline couplings and apply grease **M** to the overall spline surfaces. This is to prevent special wear called "fretting corrosion" which will occur due to fine vibration in motion.

NOTE:

(1) For those couplings joined to the gear end, do not use Molykote grease or other grease containing molybdenum disulfide, but apply machine oil to those couplings.

(2) After lubrication, be sure to tighten screws firmly.

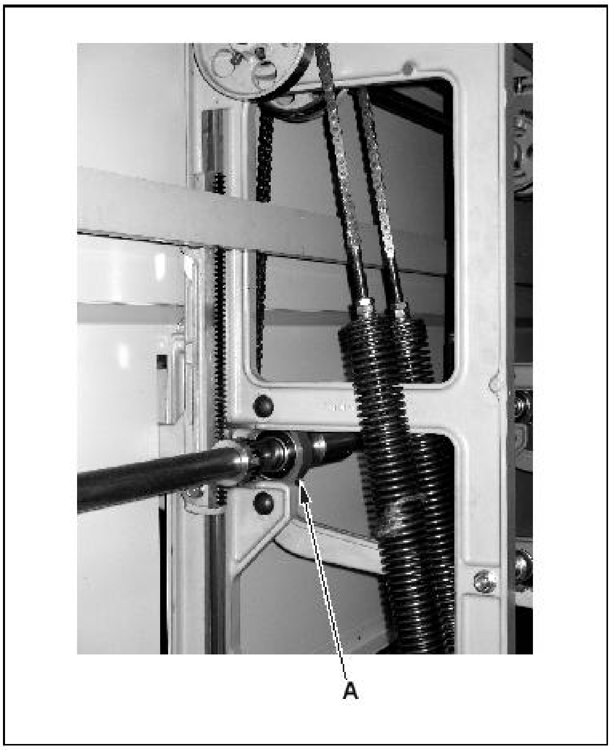


[6] Semiyearly (Every 24 weeks)

Top roller bearings

Lubrication tools:	Grease gun (Tool No. 77140-00004)
Lubricant:	Lubricant **K**

Bearings of top rollers (Lubricant **K**)

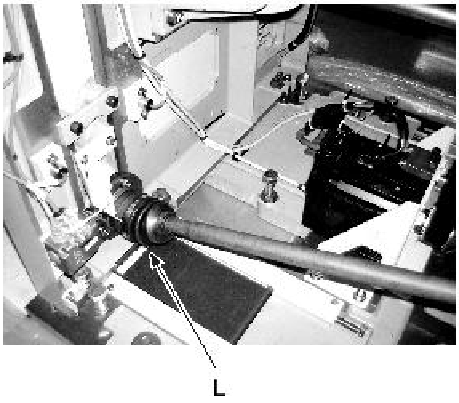


[7] Yearly (Every 48 weeks)

Unit bearing on the lifter shaft

Lubrication tools:	Grease gun (Tool No. 77140-00004)
Lubricant:	Lubricant **A**

Unit bearing (Lubricant **A**)



[8] At the end of the boot service life

■ Universal joint in the GE head

Lubrication tools: Brush
Lubricant: Lubricant **L**

If the boot breaks at the end of its service life, apply grease to the universal joint in the boot. For the replacement procedure of the boot, refer to Subsection M.3.3.

Universal joint inside the boot (Lubricant **L**)

M.1.4 Lubricating Records

FL No. ______ Carried out by: ______ From (date) ______ to (date) ______

Lubricating Intervals H: Hours W: Weeks	Lubricating Points	Time elapsed (Fill in the lubrication schedule.) 6W (/)	12W (/)	18W (/)	24W (/)	30W (/)	36W (/)	42W (/)	48W (/)	
• 768H-2592H	Manual refill of grease to the automatic lubricator tank									
• 1W	Metal section of the oscillating rods	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐
	Lifter racks Lifter slides	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐
• 2W	Balance spring chains OE balance weight chains	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐
• 6W	Bottom roller neck bearings	☐	☐	☐	☐	☐	☐	☐	☐	
• 12W	Bearings in the GE head (8 points) *Bobbin rail slide *Bobbin drive bracket *Bobbin drive tension pulley bracket *Pedestal *Flyer drive bracket *Flyer drive tension bracket *Flyer drive shaft bracket *Lifter gear		☐		☐		☐		☐	
	Lifting gear box *Oil filter cleaning	(First maintenance for new FLs)	☐		☐		☐		☐	
	*Differential gear box	☐	☐		☐		☐		☐	
	Apply Molykote grease to the oil pump axis	☐	☐	☐	☐	☐	☐	☐	☐	
	Couplings on the flyer shafts and bobbin shafts		☐		☐		☐		☐	
• 24W	Top roller bearings				☐				☐	
• 48W	Unit bearings on the lifter shafts								☐	
• When boot is replaced	Universal joints in the GE head									
• 96W	Gear boxes for the winding motors								96W Scheduled date: ( )	☐

(Entry example: After maintenance, mark the empty box, e.g., ■.)

Section M.2
Maintenance

M.2 Maintenance M.2-2

M.2.1 Daily Cleaning M.2-3

[1] When necessary M.2-3

M.2.2 Ordinary Maintenance (Semimonthly, every 1.5 months, and semiyearly) M.2-4

[1] Every 0.5 month (2 weeks) M.2-4

[2] Every 1.5 months (6 weeks): Cleaning M.2-6

[3] Every 1.5 months (6 weeks): Checking M.2-12

[4] Semiyearly (Every 24 weeks): Cleaning M.2-14

M.2.3 Special Maintenance (Yearly and triennially) M.2-15

[1] Yearly (Every 48 weeks) M.2-15

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M.2.4 Ordinary Maintenance Record M.2-16

M.2.5 Check Sheet (for 1.5-month and yearly maintenance) M.2-17

M.2 Maintenance

To make the most of the capabilities built in s, maintain high quality roving, and extend machine life, the maintenance work given in this section should be performed properly and carefully.

The maintenance (cleaning and inspection) intervals will vary depending upon the type of fibers used, roving weight produced, spinning facilities of your plant, and other conditions. This section gives you the typical maintenance intervals and procedures.

The maintenance work is classified into two types: ordinary maintenance (semimonthly and every 1.5 months) and special maintenance (yearly and triennially).

After completion of maintenance work, be sure to have the maintenance supervisor inspect the job.

DON'T TURN THE SWITCH ON

⚠ CAUTION

During the maintenance work, be sure to observe the rules given in Section S.1, Subsection S.1.3, "Rules for Maintenance."

M.2.1 Daily Cleaning

⚠ CAUTION

Before cleaning, be sure to stop the FL and put up the warning notice "NEVER TURN THE SWITCH ON." on the main circuit breaker (CB1)

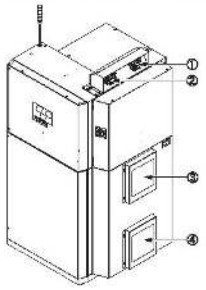
[1] When necessary

Determine the cleaning intervals for the fiber path and its surroundings given below according to the fiber used, in order to prevent the quality of roving from becoming affected by the accumulated fly or fleece.

Clean these sections according to the scheduled intervals.

Tools:
- Brush
- Hand picker
- Floor blush
- Waste cloth

- Flyer rail and roller beam
  (Clear fly or fleece.)
- Flyer spindles
  (Wipe them with a cloth dampened with silicone oil.)
- Top clearer
  (Clear accumulated fibers.)
- Bobbin rail
  (Clear fly or fleece.)
- Floor
  (Clean the floor in front of and at the rear of the FL.)
- CWC belt, pulleys (located at both of GE and OE) and their surroundings
  (Remove fly or fleece.)
- Fan cover on top of the GE head
  (Remove fly and fleece (1), (2))
- Fan cover mesh on the GE head
  (Remove any fly or fleece from the mesh sections on the back of the machine. (2 places: (3) and (4))



M.2.2 Ordinary Maintenance (Semimonthly, every 1.5 months, and semiyearly)

DON'T TURN THE SWITCH ON

⚠ CAUTION

Be sure to stop the FL and put up the warning notice "NEVER TURN THE SWITCH ON." on the main circuit breaker (CB1).

It is recommended that you make a note of the ordinary maintenance carried out, on the "Ordinary Maintenance Record" given in Subsection M.2.4.

[1] Every 0.5 month (2 weeks)

Tools:
- Brush
- Hand picker
- Floor blush

■ **Back of the FL**

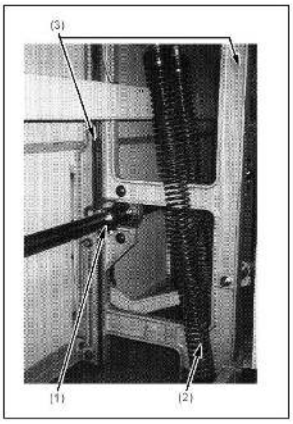
(1) Remove fly or fleece from the lifter racks and pinions.

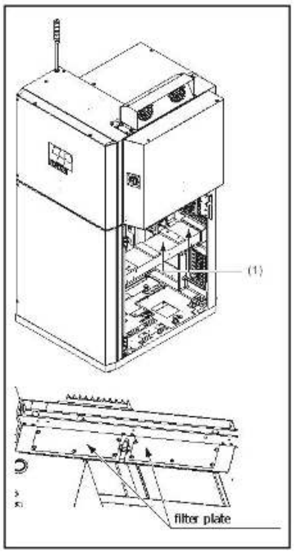
(2) Remove fly or fleece from the balance springs and chains.

(3) Remove fly or fleece from the lifter slides and spring pieces.

(4) Clean the creel and its surroundings.

(5) Clean the floor.





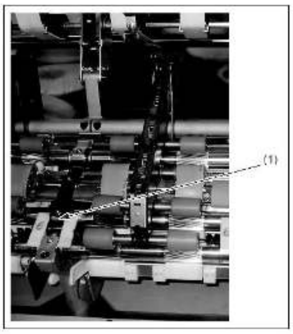
(6) Clean the control box and filter mesh

1) Open the back bottom cover and use a brush to clean fly and fleece from the under side of the filter plate

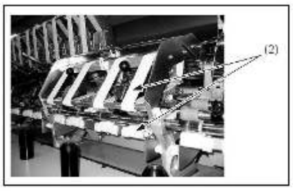
[2] Every 1.5 months (6 weeks): Cleaning

- **Roller part**

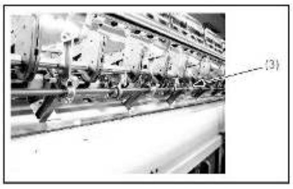
Tools:	Hand picker



(1) Remove fibers entangled around the bottom roller neck.



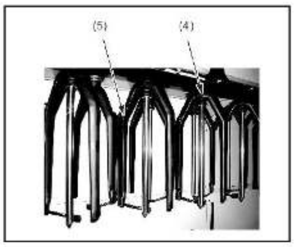
(2) Remove fly or fleece accumulated on the top and bottom faces of the top and bottom clearers.



(3) Remove fly or fleece accumulated on the clearer drive shaft.

■ Flyer rail, flyer

Tools:
- Vacuum cleaner
- Cotton rope
- Brush or mop
- Waste cloth



(4) Clean the bottom of the flyer rail.

(5) Clean the roving path in the flyers.

Either pass a cotton rope wetted with cresol or other volatile solvent through the pipe and rub the inside of the pipe to remove cotton wax and oil, or pass and rotate a brush in the pipe for cleaning.

Though the oil itself can easily be removed with hot water, it is rarely used because of much time and labor for drying after the cleaning.

Method for cleaning with cotton rope

What should be prepared

- 1,200 mm long cotton rope (around Ne20) whose thickness or several knots made in the middle can barely pass the pipe
- Container for cresol or hot water
- About 900 mm long copper wire with a hooked end to pass the wire rope through the flyer pipe (it should not damage the inside surface of the pipe and should be about 200 mm longer than the overall flyer pipe length)

Procedure

1) Remove the flyer cap.
2) Pass the copper wire upward with its hooked end first from the bottom hole of the flyer until the hooked end appears at the top.
3) Tie the cotton rope wetted with volatile solution or hot water to the hook of the copper wire, and pull the wire downward until the cotton rope appears from the bottom end of the flyer pipe.
4) Pull the rope passing the pipe up and down repeatedly for cleaning inside the pipe.

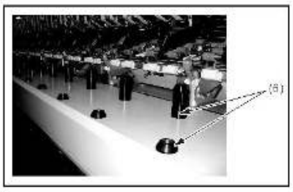
Method for cleaning with a rotating brush

What should be prepared

- Special service tool F8201-57010-00 (FL-37). See G.1.1 [3]
- An electric hand drill that is able to chuck a ø10 shaft.

Procedure

1) Remove the flyer cap.
2) Pass the brush portion of special service tool F8201-57010 from the hole on top of the flyer until the leading end of the brush appears from the bottom hole.
3) Chuck the brush shaft with the electric hand drill and run the drill for about 10 seconds.



(6) Always in contact with the passing roving (like the top roller rubber cots), the flyer caps have been made of urethane rubber, which provides the required surface-smoothness and wear resistance.
Clean the flyer caps with a moistened cloth to remove oil and cotton dust and then wipe the cap surfaces with a dry cloth to remove the moisture.

If the flyer caps are heavily contaminated, soak them in tepid water (30°C to 40°C) for approx. 30 minutes and then wipe them.

NOTE:

1. Do not soak the flyer caps in water or hot water for a long time since urethane rubber is not water-resistant. The service life will be shortened.
2. Do not use neutral detergent or cleaner.
3. Avoid drying the flyer caps with warm air.

■ **Bobbin rail**

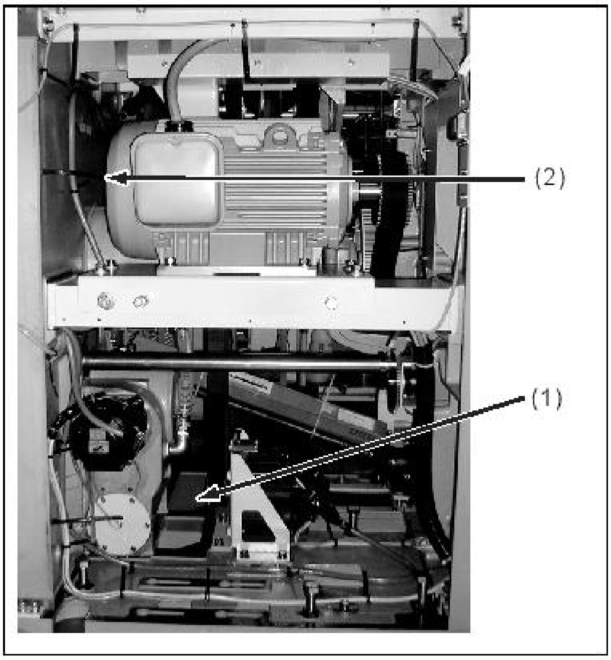
Tools: Brush or mop

Clean the bobbin rail and its surroundings.

■ **Main gearing**

Tools: Vacuum cleaner

Open the GE door and clear fly or fleece.

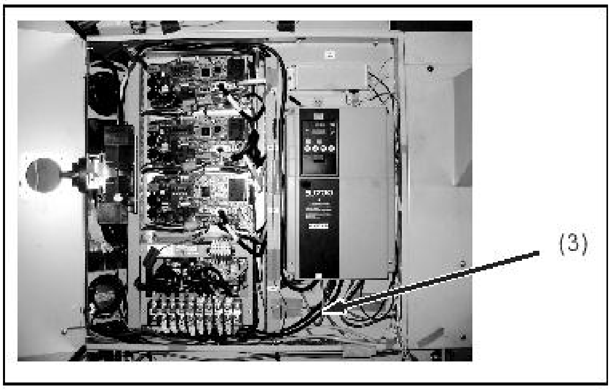


Inside the GE head

Tools: Vacuum cleaner

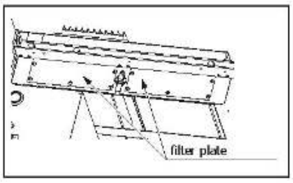
(1) Remove fly or fleece from inside the gear end (GE) head.

(2) Clear fly or fleece from the motor fan cover and cooling fan mesh.



(3) Clean the inside of the control box (INV1 to INV3) with a vacuum cleaner.

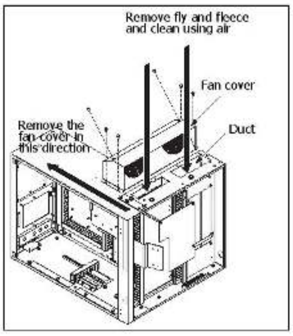
NOTE: Never use spray-clean such as air-blow. Invasion of fly or fleece into electric parts may cause damaged components.



(4) Remove fly or fleece that has accumulated on the cooling fins and cooling fans located on the back of the cooling duct.

⚠ CAUTION

Before accessing the inside of the control box, always turn off the main circuit breaker (CB1) and wait at least 20 minutes. This is because even after the main circuit breaker is turned off, the inverter capacitor will remain charged for a while.


Remove fly and fleece and clean using air
Fan cover
Duct
Remove the fan cover in this direction

1) Remove the filter plate clamp and open the plate.

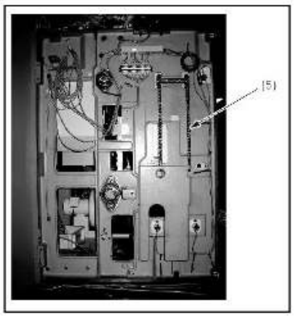
2) Remove the 6 bolts from the fan cover on the top of the control box and then remove the fan cover in the direction shown by the arrow.

3) Remove the fly and fleece that has accumulated on the tops of the fins in the ducts and on top of the control box. Remove the fly and fleece from inside the ducts using air, etc.

4) Clean off the fly and fleece that have accumulated on the inside face of the filter plate with a brush, air, etc.

5) Close the filter plate and clean off any remaining fly and fleece with a brush, air, etc.

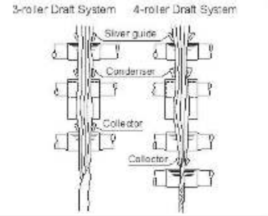
6) Return the fan cover to its original position.



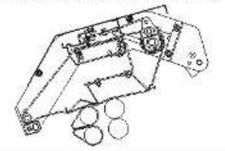
- **OE**

Tools:	Vacuum cleaner

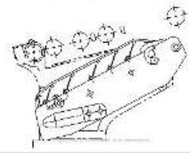
(5) Open the out end door and remove any fly or fleece that has accumulated.


3-roller Draft System 4-roller Draft System

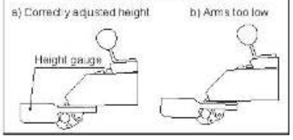
Setting the Cloth Guides to the Top Clearers



Setting the Cloth Guides to the Bottom Clearers



Height Adjustment of Weighting Arms


a) Correctly adjusted height b) Arms too low

[3] Every 1.5 months (6 weeks): Checking

■ Roller part

Tools:	Height gauge (ASP10335)

(1) Check the sliver guides, condensers, and collectors for damage.
Clean if contaminated with oil, etc. For cleaning, do not use any chemical but use hot water at 35 to 40°C.

(2) Check the top and bottom aprons to make sure they are not damaged or missing. If any problem is found, replace them.

(3) Check the top and bottom clearers. If any one does not work properly, adjust it.

(4) Check the pressurized state of the weighting arms by using a height gauge.

■ Main gearing

(1) Check the engagement of the lifting gears.

(2) Check the tension of the timing belt.

■ Draft gearing

Check the engagement of the gears.

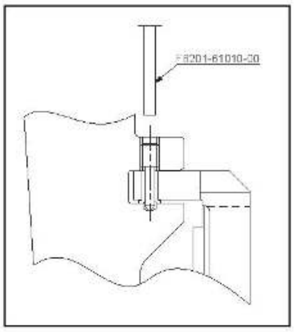
■ Other points

(1) Check the safety door switches.

(2) Check the phototube stop motion.

(3) Check the actuation points of the limit switches (whether their actuators lower/rise excessively or not).
Check the distances between the proximity switches and their dogs.

(4) Check tightening bolts for looseness.


F8201-61010-00

(5) Check the upper presser support pins for wear.

⚠ WARNING

If the upper presser support pins wear so as to break when the FL100 is in operation, they may bounce off. It is DANGEROUS. To prevent such an accident, be sure to check and replace the upper presser support pins with the following steps:

1) Check the support pins of those spindles in the front row at the center of each interval between the spring pieces, for looseness caused by wear.

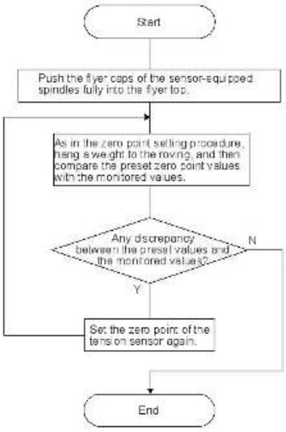
2) Take out the support pins of 2 to 3 spindles that seem worn greatly, and then measure their diameters with a vernier calipers. If they have worn down to a diameter of 2 mm or less (dia. of new parts: 3 mm), replace the support pins of all spindles with brand-new E pins.

■ Tension sensor setting

Tools: Leveling string and weight

To keep the tension sensors in the optimum setting condition, check the tension sensors according to the flowchart given at left.

Checking the Roving Tension Sensor


Start
Push the flyer caps of the sensor-equipped spindles fully into the flyer top.
As in the zero point setting procedure, hang a weight to the roving, and then compare the preset zero point values with the monitored values.
Any discrepancy between the preset values and the monitored values?
N
Y
Set the zero point of the tension sensor again.
End

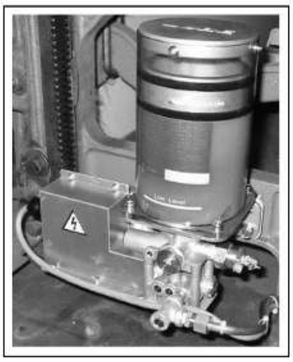
[4] Semiyearly (Every 24 weeks): Cleaning

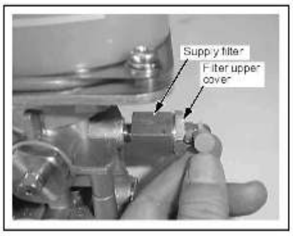
Maintenance materials: Washing oil

- **Grease tank refilling filters of the centralized lubrication system**

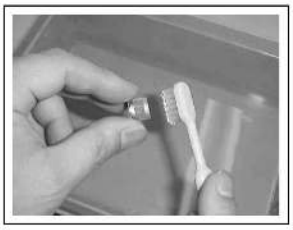
  The refilling filter mounted in the grease tank of the centralized lubrication system may become clogged with fly, fleece or other foreign materials if you remove the top cover or use a grease gun with a contaminated nozzle tip, in order to supply grease.

  Check and clean those filters according to the procedure given below so that the centralized lubrication system applies grease to the gears automatically and properly.





The supply filter is housed inside. Remove the upper cover and take the wire mesh filter element out.



Wash the removed filter element with kerosene and fit it in the filter body.

M.2.3 Special Maintenance (Yearly and triennially)

DON'T TURN THE SWITCH ON

⚠ CAUTION

Be sure to stop the FL and put up the warning notice 'NEVER TURN THE SWITCH ON.' on the main circuit breaker (CB1).

[1] Yearly (Every 48 weeks)

Check the FL according to the Check Sheet given in Subsection M.2.5 and adjust or replace faulty sections if any, while keeping the amount of disassembly of the FL down to a minimum.

[2] Triennially

Check the levelness of the FL between the left and right sides, as well as between front and back on the top of the roller beam triennially.

Level to be used
  Name:Level exclusively designed for FLs
  Parts number:No. 77133-00007
  Sensitivity:One scale = 0.5 mm/m
Allowable irregularity in the frame levelness:± 2 scales

If the FL is out of the allowable irregularity, remove the flyer rail and its related sections and adjust the levelness.

M.2.4 Ordinary Maintenance Record

FL No. ____________ Carried out by: ____________ From (date) ____________ to (date) ____________

Intervals W:Weeks	Cleaning Points	Time elapsed (Fill in the lubrication schedule.) 6W (／)	12W (／)	18W (／)	24W (／)	30W (／)	36W (／)	42W (／)	48W (／)
2W	• Back of the FL 1) Lifter racks and pinions 2) Balance spring chains 3) Lifter slides and spring pieces 4) Creels and their surroundings 5) Floor 6) Filter mesh under the control box	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
6W	• Roller parts 1) Bottom roller necks 2) Clearers 3) Clearer drive shafts 4) Suction ducts	☐	☐	☐	☐	☐	☐	☐	☐
	• Flyer rails 1) Underside of the flyer rails 2) Roving path in the flyers 3) Flyer caps	☐	☐	☐	☐	☐	☐	☐	☐
	• Bobbin rails 1) Bobbin rails and their surroundings	☐	☐	☐	☐	☐	☐	☐	☐
	• Main gearing 1) Inside the GE doors	☐	☐	☐	☐	☐	☐	☐	☐
	• Inside the GE head 1) Inside the head 2) Motor fan covers 3) Inside the control boxes 4) Inside the control box cooling ducts	☐	☐	☐	☐	☐	☐	☐	☐
	• OE 1) Inside the OE doors	☐	☐	☐	☐	☐	☐	☐	☐
24W	• Grease tank filters of the centralized lubrication system				☐				☐

(Entry example: After maintenance, mark the empty box, e.g., ■ .)

M.2.5 Check Sheet (for 1.5-month and yearly maintenance)

FL No. ________ Carried out by: ________ From (date) ________ to (date) ________

OK	■	NG	◩	Adjust	☐ A	Repair	☐ △	Tighten	☐ T	Replace	☐ R	Clean	☐ C	Lubricate	☐ L

	Check Points	Check for	Time elapsed (Fill in the schedule.) 6W (/)	12W (/)	18W (/)	24W (/)	30W (/)	36W (/)	42W (/)	48W (/)	Checking Method	Remarks
GE main gearing	Timing belts	Tension	☐	☐	☐	☐	☐	☐	☐	☐		
		Lack of teeth				☐				☐	Visual check	
	Gears	Engagement	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	0.3 to 0.5 mm
		Teeth wear				☐				☐	Visual check	
	Main gear boxes	Oil leakage		☐		☐		☐		☐	Visual check	
		Oil level		☐		☐		☐		☐	Level gauge	
	Lifting gear boxes	Oil leakage		☐		☐		☐		☐	Visual check	
		Oil level		☐		☐		☐		☐	Level gauge	
	Differential gear boxes	Temperature								☐	Tactual check	
		Abnormal noise								☐	Auditory check	
	Hard twist clutch & pulley bearing (optional)	Wear of torque transmission pins				☐				☐	Visual check after partial disassembly	Pin pressing condition
		Rotating status of bearing				☐				☐	Manual operation after partial disassembly	
Flyer rails	Flyer drive gears	Operation of the centralize lubrication system	☐	☐	☐	☐	☐	☐	☐	☐	Manual operation	
		Wear				☐				☐	Visual check	
	Flyers	Wear of upper presser support pins	☐	☐	☐	☐	☐	☐	☐	☐	Vernier calipers	Dia. of pins: 2 mm or more
		Pressers' movement								☐	Manual operation	
		Stains or scratches								☐	Visual check	
		Arbors' fluctuation								☐	Visual check	
	Couplings	Wear								☐	Visual check	
Bobbin rails	Bobbin drive gears	Operation of the centralize lubrication system	☐	☐	☐	☐	☐	☐	☐	☐	Manual operation	
		Wear				☐				☐	Visual check	
	Bobbin rails	Chatter				☐				☐	Visual check	
		Leveliness lengthways								☐	Ruler	Overall: Within 1 mm
	Lifter slides	Fleece accumulation								☐	Visual check	

Entry example: ■, ◩, or ☐ A
└ Action taken

OK	■	NG	◩	Adjust	☐A	Repair	☐△	Tighten	☐T	Replace	☐R	Clean	☐C	Lubricate	☐L

	Check Points	Check for	6W (/)	12W (/)	18W (/)	24W (/)	30W (/)	36W (/)	42W (/)	48W (/)	Checking Method	Remarks
	Couplings	Wear								☐	Visual check	
	Universal joints	Breakage of boots				☐				☐	Visual check	Refill grease at the time of replacement
		Vibration								☐	Auditory check	
	Balance	Balanced state								☐		
Roller parts	Top rollers	Stains or scratches	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
		Parallelism								☐	Visual check	
	Aprons	Stains or scratches	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
		Fluctuation	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
	Bottom rollers	Stains	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
		Fluctuation								☐	Dial gauge	Within 0.03
	Weighting arms	Pressurized state	☐	☐	☐	☐	☐	☐	☐	☐		
		Mounting position								☐	Visual check	
	Draft gearing	Engagement	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	0.2 to 0.3 mm
		Wear								☐	Visual check	
	Clearers	Rotation of cloth	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
		Positions of cloth holders								☐	Visual check	
		Fleece-scraped state	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
	Sliver guides, condensers, and collectors	Presence or lack	☐	☐	☐	☐	☐	☐	☐	☐	Visual check	
Other sections	Safety door switches	Actuation (SWDR 1 to 4)	☐	☐	☐	☐	☐	☐	☐	☐	Manual operation	Check by the I/O monitor
	Limit switches	Actuation (LSUP and LSDW)	☐	☐	☐	☐	☐	☐	☐	☐	Manual operation	Check by the I/O monitor
	Proximity switches	Distances to the dogs (PRS001)	☐	☐	☐	☐	☐	☐	☐	☐	Thickness gauge	3 mm

Entry example: ■, ◩, or ☐A
└ Action taken

OK	■	NG	◩	Adjust	☐ A	Repair	☐ △	Tighten	☐ T	Replace	☐ R	Clean	☐ C	Lubricate	☐ L

	Check Points	Check for	6W (/)	12W (/)	18W (/)	24W (/)	30W (/)	36W (/)	42W (/)	48W (/)	Checking Method	Remarks
Photoelectric stop motions	Light emitters and receivers	Alignment of optical axes	☐	☐	☐	☐	☐	☐	☐	☐		
	Sensitivity adjusters	Working state	☐	☐	☐	☐	☐	☐	☐	☐		
Drivers	Main motor (M001)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	Winding motor (M002)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	Lifting motor (M003)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	Drafting motor (M004)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
Controllers	Control boxes	Loose terminals or connectors								☐		
	Inverters	Daily inspection	☐	☐	☐	☐	☐	☐	☐	☐	To be performed according to the instructions in Section 7.1.8 [3], "Cleaning and Inspection at Periodical Maintenance."	
		Periodical inspection								☐		
Other sections	CWC motor (M100)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	Blower motor (M101)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	BS cleaner motor (M102)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	Cross flow fan motor (M103)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	Fan motors	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	
	BS suction motor (M104)	Abnormal noise or vibration		☐		☐		☐		☐	Auditory check	

(Entry example: ■ or ◩, or ☐ A ←Symbol expressing action performed)

Section M.3
Disassembly/Reassembly/Adjustment
(Maintenance and Inspection of Major Parts)

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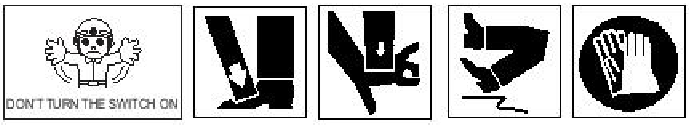
M.3 Disassembly/Reassembly/Adjustment (Maintenance and Inspection of Major Parts)


DON'T TURN THE SWITCH ON

⚠ CAUTION

Be sure to observe the rules given in Section S.1, Subsection S.1.1, "Rules for Installation Work" and S.1.3, "Rules for Maintenance."

M.3.1 Driving Shaft and Differential Gear Box

[1] Check

- Check the surface temperature of the differential gear box casing during operation.
  If it is abnormally high,
  - the differential gear box has undergone some overload or
  - it has either lacked oil or had too much oil.
- Check for noise.
  If any abnormal noise occurs,
  - the gears are worn or broken or
  - the differential gear box is lacking oil.
- Check for oil leakage.
  If oil leaks, the oil seals have become defective.

[2] Oil Change

- Refill oil via the refill opening (after removing the air-bleeding plug).
- When draining oil from the differential gear box for disassembly, place the drain container under the drain plug provided at the bottom of the differential gear box casing and remove the plug.

[3] Disassembly Procedure

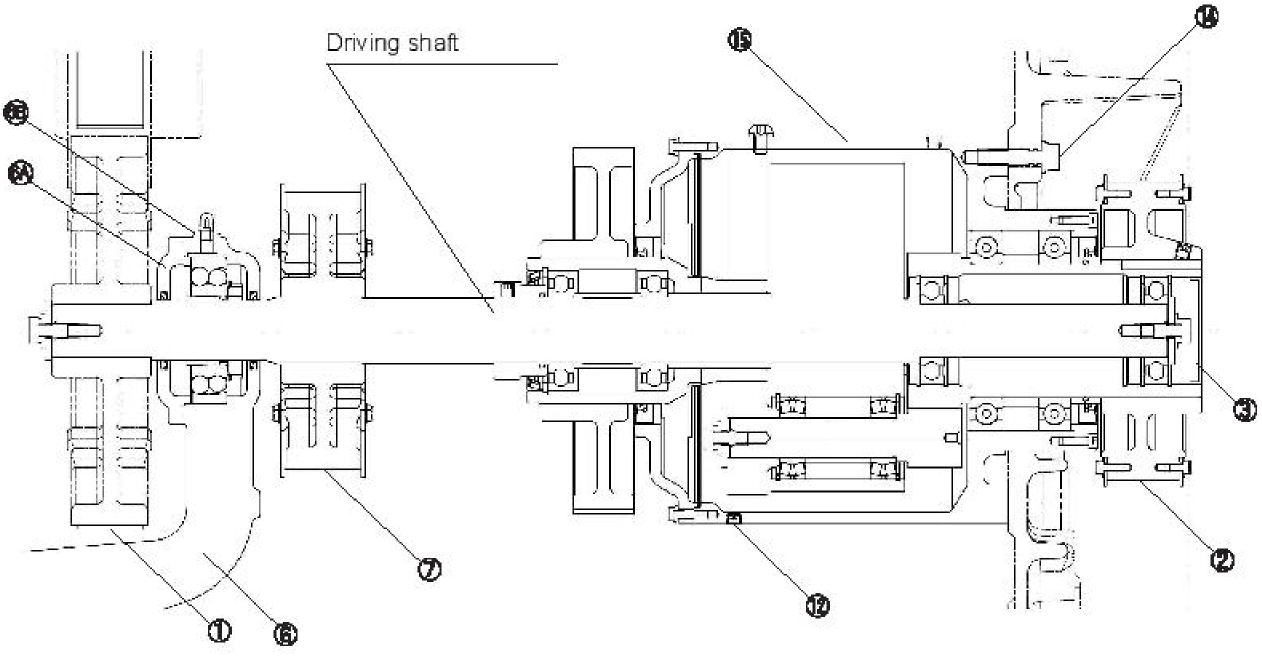
REFERENCE:

- Determine how much disassembly will be necessary in each case, so that you can keep disassembly down to the absolute minimum.
- Take special care not to crush your hands. Each component of the differential gear box is HEAVY.
- Oil seals and seal caps that have been removed can not be reused again, so replace them with new ones.
- Firmly tighten the screws.

(1) Taking out the driving shaft assembly and differential gear box from the GE head

1) First, remove the drain plug ⑫ on the bottom of the casing to drain the oil. Also remove the piping from the top and bottom of the casing.
2) Remove three timing belts from the driving shaft.
3) Remove driving pulley ① and pulley ② from the ends of the driving shaft by loosening their set screws. (Also remove the keys and store them.)
4) Remove the seal cap ③
5) Remove the cap (6A) from pedestal ⑥ by removing four tightening screws.
6) Take off the upper section of the bearing housing (6B) by removing two tightening screws.
7) Put a sturdy board extending from the top of the lifting gear box to the front of the GE door and supporting the bottom of casing ⑮. This board will serve as an auxiliary support when you separate and take out the casing.
8) Take off pedestal ⑥ by removing two tightening screws.
9) Remove three bolts ⑭ which secure casing ⑮ to the main gear box.
10) Slightly lift up the OE end of the driving shaft and pull the driving shaft assembly towards the OE by approx. 60 mm, then take it out towards the front of the FL.

Driving Shaft and Differential Gear Box



(2) Separating the casing from the driving shaft assembly

1) Remove bearing (6C) of the pedestal.

2) Pull out pedestal's grease seal (6D) from the driving shaft.

3) Remove pulley ⑦ from the driving shaft.

4) Pull out timing pulley ⑧.

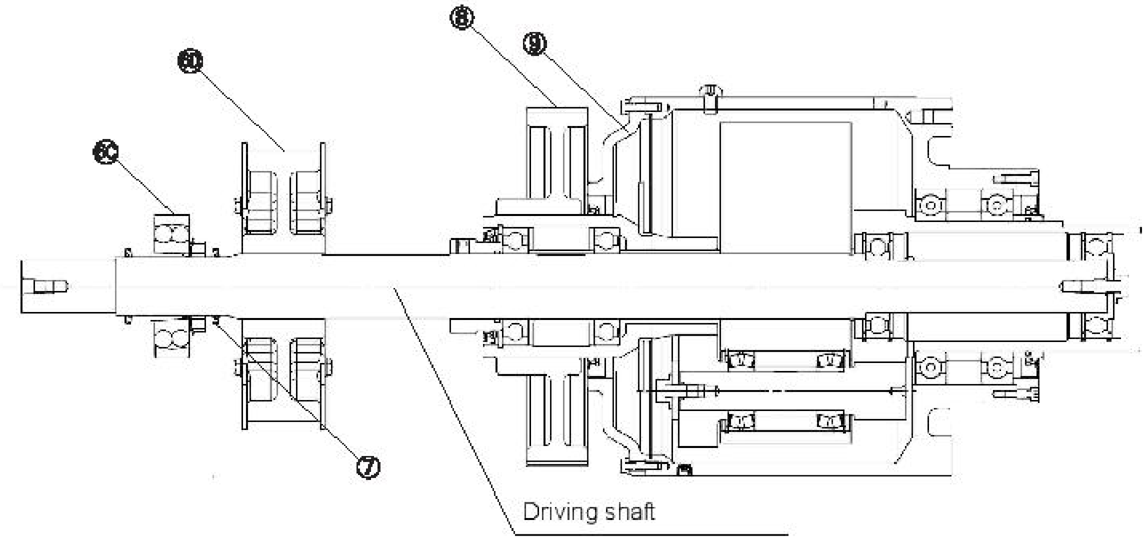
5) Remove the screws which secure OE cap ⑨, then screw a bolt (ø6 mm) having a less than 20 cm or more threaded section into each screw hole to separate the joint section.

6) Remove OE cap ⑨.

7) Remove the casing from the driving shaft assembly in the following manner:
Hold the OE end of the driving shaft and apply a wooden pad to the GE end of the shaft. While slightly moving the OE end up and down, lightly tap the wooden pad with a hammer until the bearing works out of the casing.

NOTE: Do not tap the driving shaft directly with a hammer.

Driving Shaft and Differential Gear Box



(3) Disassembling the driving shaft assembly (if necessary)

NOTE: Take care not to lose the removed parts.

A) To remove long socket pinion Ⓐ and its ball bearing or the oil seals:

1) Remove set hoop ⑩ by loosening its set screws.

2) Loosen square-head set screws which secure arm ⑬.

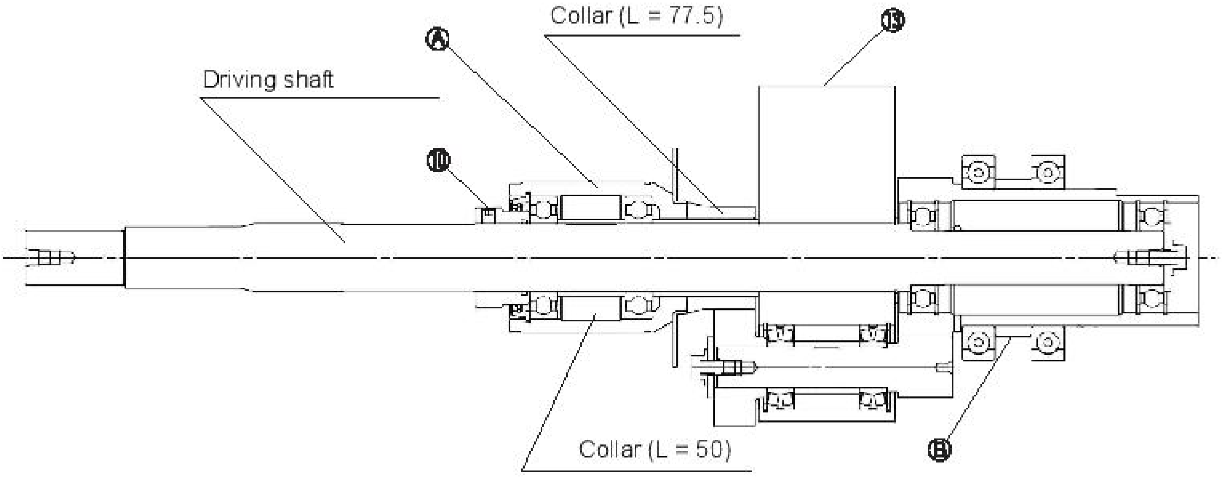
3) Put a thick wooden board on a firm floor and place the driving shaft on the board with its GE end facing up.

4) Grip the top end of the driving shaft, lift up the driving shaft assembly, and drop it vertically onto the wooden board. Repeat this job until long socket pinion Ⓐ works out.

B) To remove long socket gear Ⓑ:

1) Place the driving shaft assembly with its GE end down, apply a metal pad to the end of long socket gear Ⓑ, then tap the pad with a hammer.

Driving Shaft and Differential Gear Box



[4] Reassembly Procedure

Reverse the disassembly procedure.

(1) Before installing parts, be sure to clean them.

(2) Driving in the bearings
Drive in the bearings, by using an appropriate tool which will: prevent the sealing surfaces of the oil seals from becoming scratched and not tap the bearings partially.

(3) Installing the oil seals
Before installing the oil seals, apply grease to the lips (joint sections with the shaft) of the oil seals.
Carefully install the oil seals. Since an oil seal consists of a thin iron plate and rubber, tapping the seal partially and directly will deform the seal resulting in oil leakage.
The installation direction of the oil seals should be as shown below; that is, the folded section of each seal should face towards the outside.

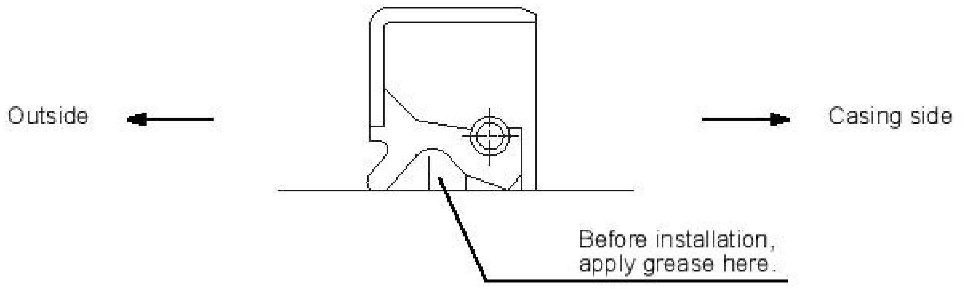
(4) Removing the liquid packing
Remove the liquid packing accumulating on the joint sections between the casing and caps, then clean the joint sections.

(5) Apply Molykote grease to the joints between pulleys ①, ②, ⑦, and ⑧ and the driving shaft.

(6) Tightening the screws inside the casing
Apply lock paint (Three-Bond 1401C) to the set screws on arm ⑬ and tighten them firmly.

(7) Applying liquid packing (Three-Bond No. 1215)
Before installing the casing and caps, apply liquid packing to the surfaces to be joined.

Installation Direction of Oil Seal



(8) Positioning the driving shaft

Tighten GE cap ④ and insert the driving shaft into the differential gear box from the OE until the bearing comes into contact with cap ④.

At the OE, position bearing (6C) of pedestal ⑥ and tighten the adapter nut.

(9) Checking the rubber oil seal rings

Before installing OE cap ⑨ to the casing, check that the rubber oil seal rings are fitted in the grooves of pinion Ⓐ.

Be particularly careful with the outside rubber oil seal ring. If it is out of the groove, oil leakage may result.

(10) Attaching the seal cap

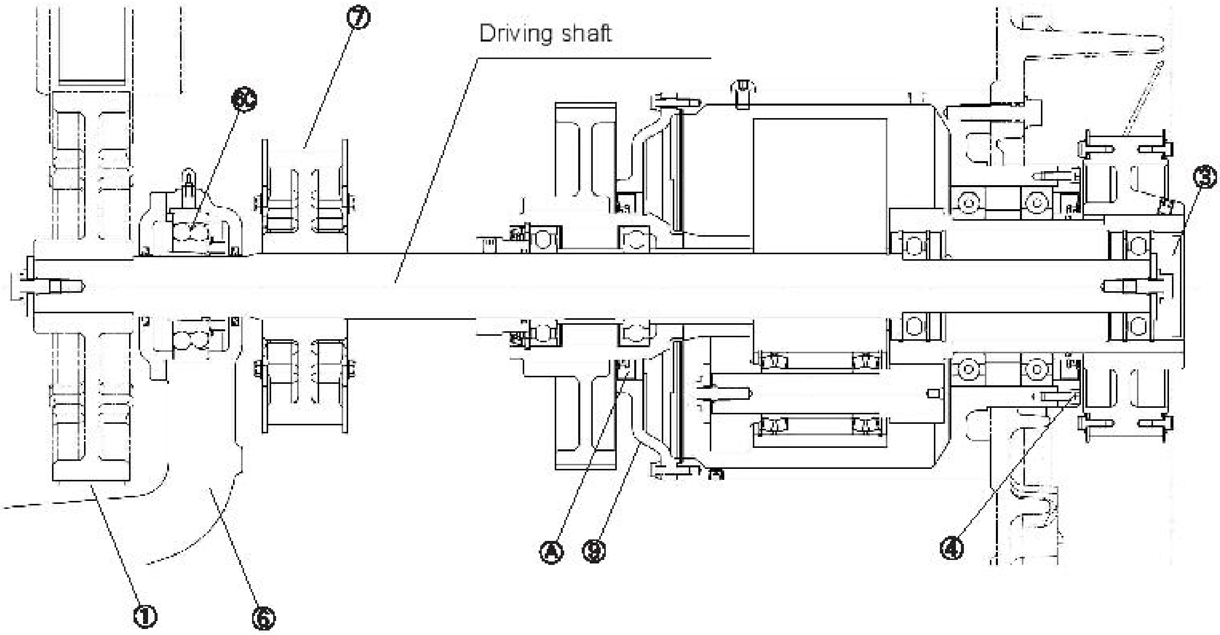
Use a brush to apply oil to the housing hole where the seal cap ③ will be attached.

Have a wooden board ready that is larger than the seal cap and lightly tap the end of the seal cap into place with the board in small steps.

(11) Refilling with oil

Refill the gear box with the specified oil. (For the lubrication method, refer to Subsection M.1.3, [5] "Main gear box in the GE head.")

Driving Shaft and Differential Gear Box



M.3.2 Lifting Gear Box

If any problem is found with the lifting motor or inside the lifting gear box, follow the disassembly procedure given below.

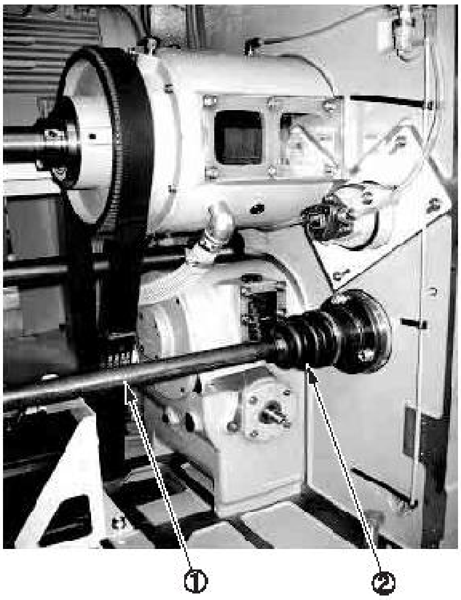
■ **Outline of the disassembly procedure**

- Drain the oil
- Removing the Universal Joint
- Remove the lifting motor
- Remove the lifting gear box
- Remove the shafts from inside the lifting gear box

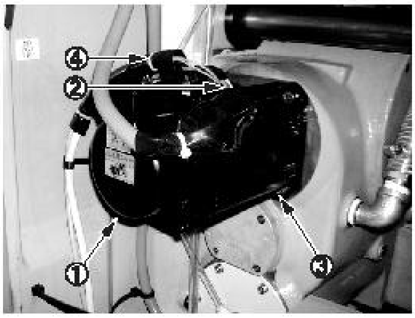
[1] Draining the oil

Refer to Section M.1.11 [3].
After the oil has been completely drained out, remove all of the tubes for piping oil.

[2] Removing the Universal Joint



(1) Adjust the height of the bobbin rail so that the shaft ① in the universal joint becomes nearly horizontal, then remove the shaft ① and coupling ②.



[3] Removing the Lifting Motor

(1) Turn the power off.

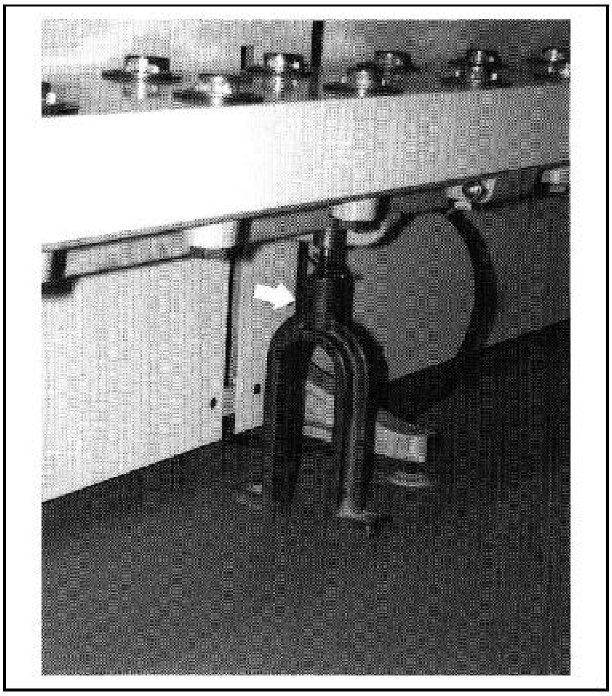
(2) Remove the banding band ④ used to fix it in place.

(3) Remove the connector ② for the power transmission line and signal line.

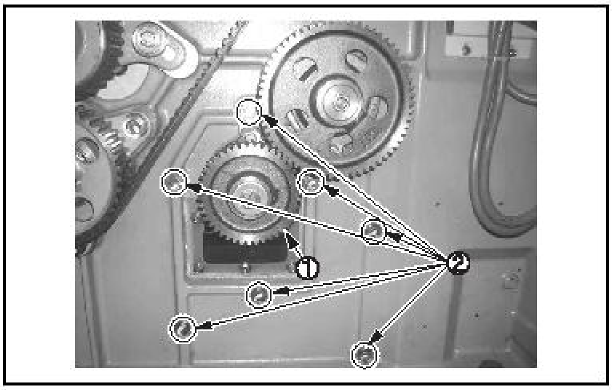
(4) Remove the fixing bolts (M8 bolts x 4) ③ while supporting the motor ①. Then separate the motor ① from the machine body.

(5) There is a round groove on the motor mounting surface of the machine body. Since an O-ring that prevents oil leakage is mounted in this groove, carefully remove the motor so as not to drop it into the lifting box.

[4] Removing the Lifting Gear Box



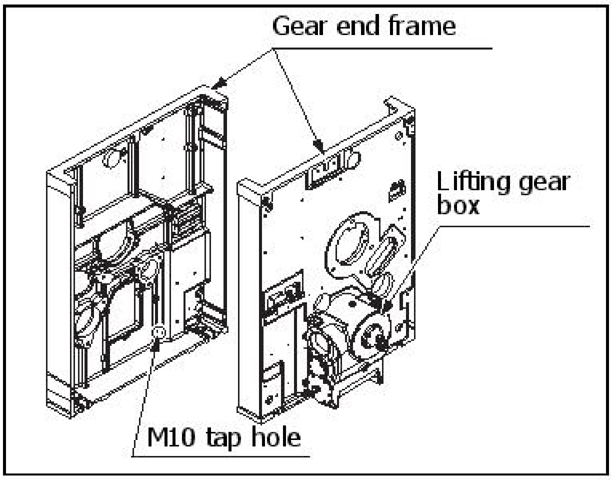
(1) Put jacks underneath the bobbin rail at intervals of approx. 20 spindles so that they can support the bobbin rail when the rail undergoes any load.



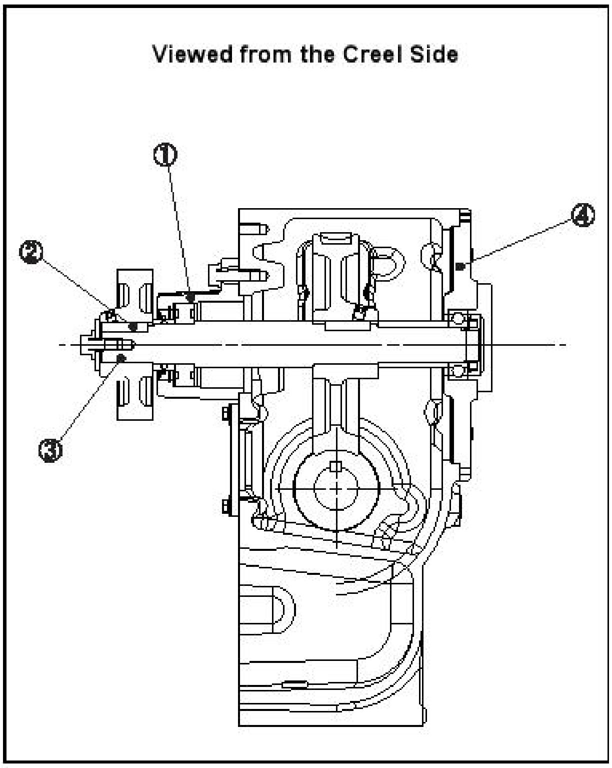
(2) Remove the lifting gear ①.

(3) Remove the bolts ② which secure the lifting gear box. (M10 bolts x 7, from the main gear box side.)

(4) Mark the current installation position on the lifting motor base.



(5) Screw an M10 bolt evenly into the tap hole in one place on the gear end frame (M10, one place). Separate the lifting gear box from the gear end frame.



[5] Taking out the Shafts from the Lifting Gear Box

(1) Removing the worm wheel shaft and its related parts

1) Remove the key ② from the lifting gear box (which has already been removed) and lightly tap the end of the shaft ③ with a plastic hammer. Remove the worm wheel shaft related parts from the gear box.

2) Remove the housing ① attachment bolts (M10 bolts, 3 places).

3) Drive a wedge into the joint section between the housing ① and the lifting box and separate them.

4) Remove the four bolts (M6 × 16ℓ) which secure the cap ④.

5) Screw M6 bolts evenly into the two tap holes (M6, 2 places) provided in the cap ④ to separate the cap from the main body.

(2) Worm shaft and its related parts

1) Loosen the set screw on gear ① and pull out the gear ①.

2) Remove cap ②.

3) Release the locking washer on bearing nut ③ by turning up the washer's pawl.

4) Remove bearing nut ③.

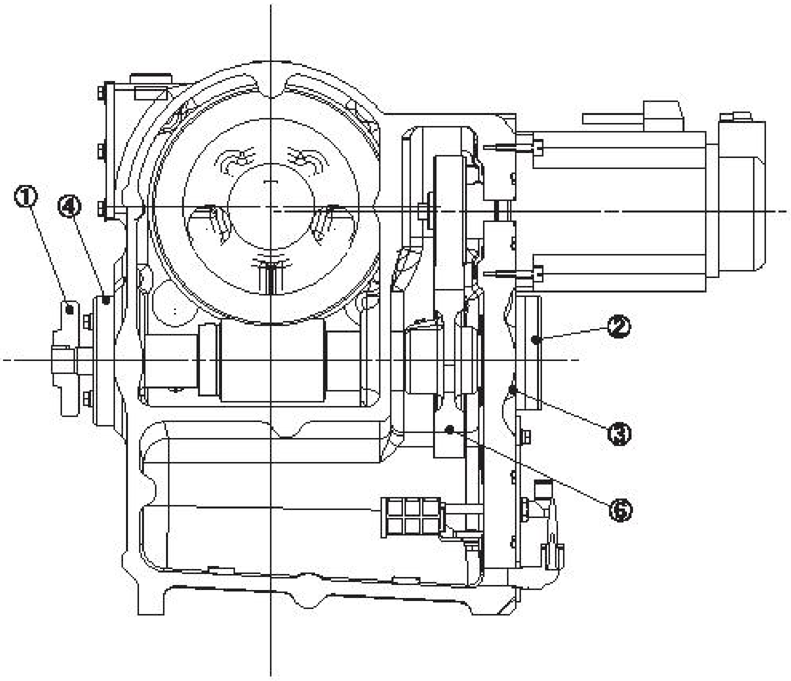
5) Screw two M6 bolts evenly into the tap holes (M6, 2 places) of the housing ④. Separate the housing from the main body.

6) Loosen the set screw on gear ⑤.

7) While moving gears ⑥ rightwards on the shaft, take out the shaft together with the worm leftwards.

(3) Installing the shafts to the lifting gear box
Reverse the disassembly procedure.

- Observe the precautions given for the differential gear box.
- (Before installation, be sure to remove old liquid packing remaining on the joint sections and apply new liquid packing (Three-Bond 1215) to those joint sections.)



M.3.3 Universal Joints

During the maintenance work, check the universal joints according to the check items given below. If any faulty universal joints are found, disassemble them and apply grease to them.

[1] Check Items

(1) When the FL is on halt

1) Check the tightening bolts for looseness
2) Check universal joints for oil leakage
3) Check that the boots are not broken or deformed

(2) When the FL is in operation

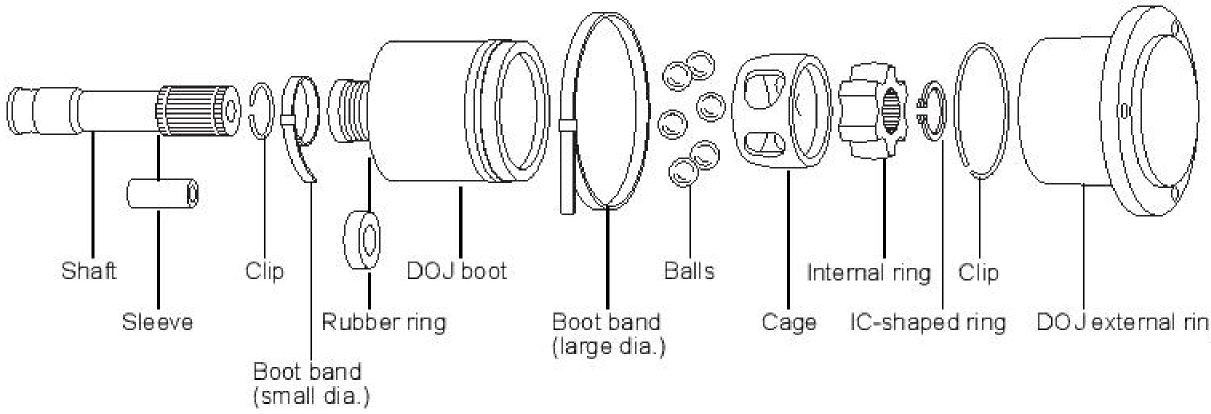
1) Check that the universal joints do not vibrate abnormally
2) Check that no abnormal noise occurs
3) Check that the shafts are not abnormally hot
4) Check universal joints for oil leakage

[2] Disassembly Procedure

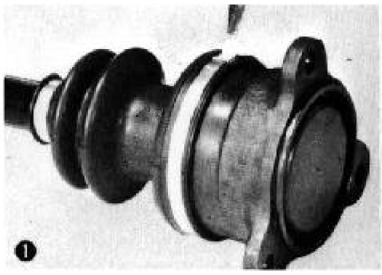
NOTE:

- Follow the specified disassembly procedure and do not apply excessive force.
- Put removed parts on a clean paper, cloth, or vinyl sheet in the order of disassembly. Do not put them directly on the floor.
- Temporarily install the small parts, bolts, and nuts (once removed) to the original position to prevent their loss.
- Wash old grease accumulating on parts with kerosene.
- Once removed, boot bands will not be used again. Replace them with new ones.
- Handle boots with care so as not to scratch them.
- When storing assembled universal joints, be sure to keep them horizontal. Otherwise, they may become deformed.
- Be sure to use the specified grease (Lubricant L: See M.1.2 Types of Lubricants and Their Properties). This is useful for preventing boots from becoming deformed due to the swell of lubricant.

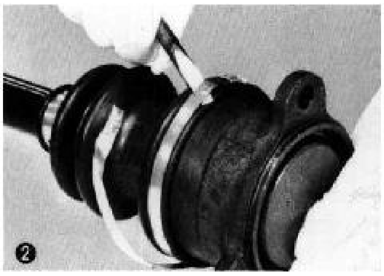
Structure of Universal Joint



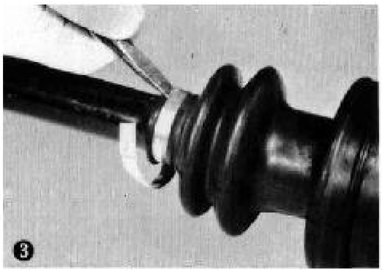
REFERENCE: Parts other than the boot and boot bands are to be replaced in the form of an assembly.



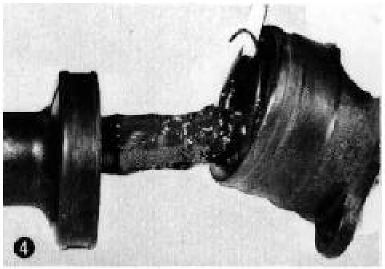
①
Turn up the clip of the large-diameter boot band with a screwdriver or the tool shown above.



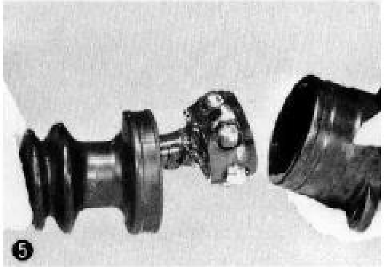
②
Taking care not to scratch the boot, loosen and remove the large-diameter boot band.



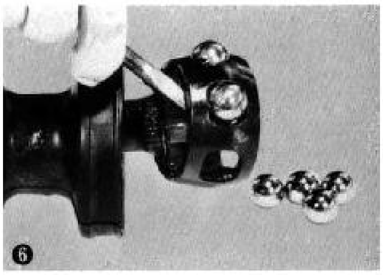
③
In the same way as for the large-diameter boot band, remove the small-diameter boot band. Then, remove the boot from the external ring.



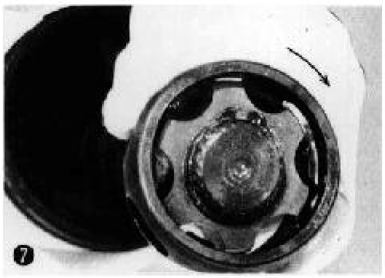
④
Remove the snap ring from the entrance of the external ring by using a pointed tool such as a marking-off pin.



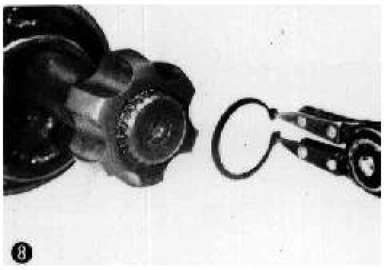
⑤
Pull out the joint from the shaft and wipe off the grease, taking care not to drop the balls.



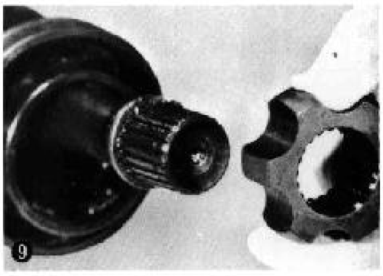
⑥
Remove the balls.



⑦
Rotate the cage on the inner ring by half pitch of the track and then shift it towards the boot. The grease used here is a special black type, so take care not to mix it with other types of grease.

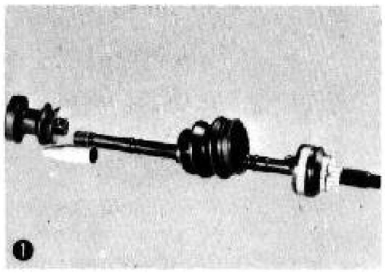


⑧
Remove the C-shaped ring which secures the inner ring to the shaft.

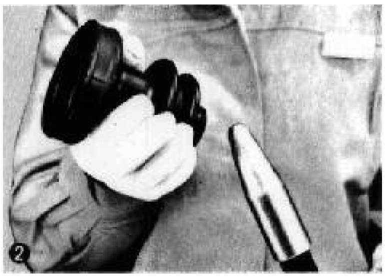


⑨
Pull out the inner ring from the shaft. Then, pull out the rubber boot. This completes the disassembly procedure.

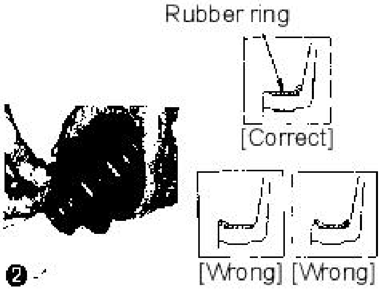
[3] Reassembly Procedure



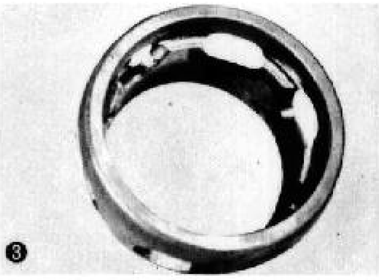
①
Use a special tool (Tool No. FL-31) shown above for step ②.



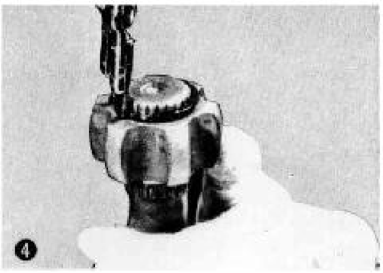
②
Taking care not to scratch the boot, fit the boot over the shaft by using the special tool shown in step ①.



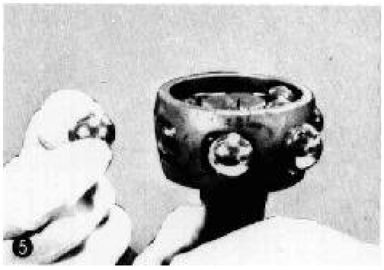
Fit the rubber ring into the groove provided in the boot.



③
Fit the cage over the shaft with the cage's cutout facing towards the shaft end.

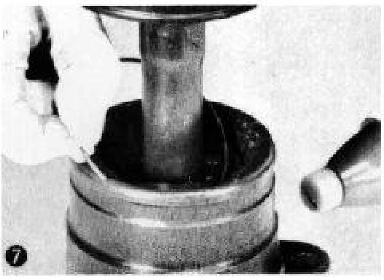


④
Set the internal ring and secure it to the shaft with the C-shaped ring.



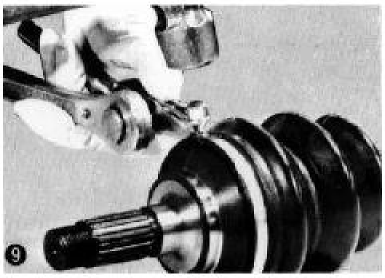
⑤
Apply grease to the cage pockets and install six balls into the cage pockets. Rotate the cage on the inner ring by half pitch relative to the inner ring track fixed to the shaft, then secure it.

⑥
Apply 100 to 120 g of the specified grease to the bottom of the DOJ external ring. (If synthetic oil is used as base oil, be careful with the swell of oil.)

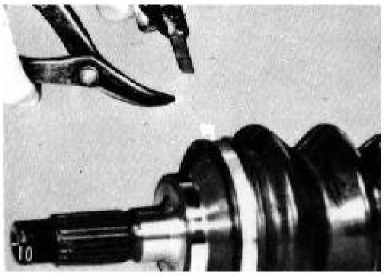


⑦
Make sure that the balls, cage, and inner ring are properly fitted in the external ring, then set the snap ring.

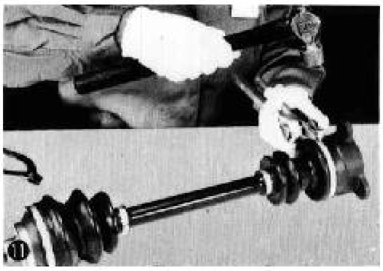
⑧
Sufficiently add grease to the inside and shaft, then fit the boot over them.



⑨
Tighten the boot with a special tool (Tool No. FL-30) shown above.



⑩
Fit the boot bands over the boot. Cut off the excess portion of those bands, but leave a small section, as long as the band width. Then, bend the remaining excess portion.



⑪
Tighten the boot bands (do not overtighten it) and tap their ends with a hammer, taking care not to scratch the boot.

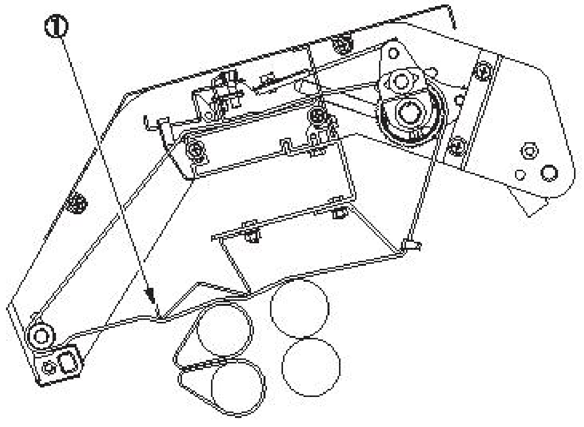
REFERENCE: If no steel band is available in steps ⑨ to ⑪, use Insu-lock (plastic fastener for wire binding).

M.3.4 Clearers

[1] Installation Procedure of Top and Bottom Clearers

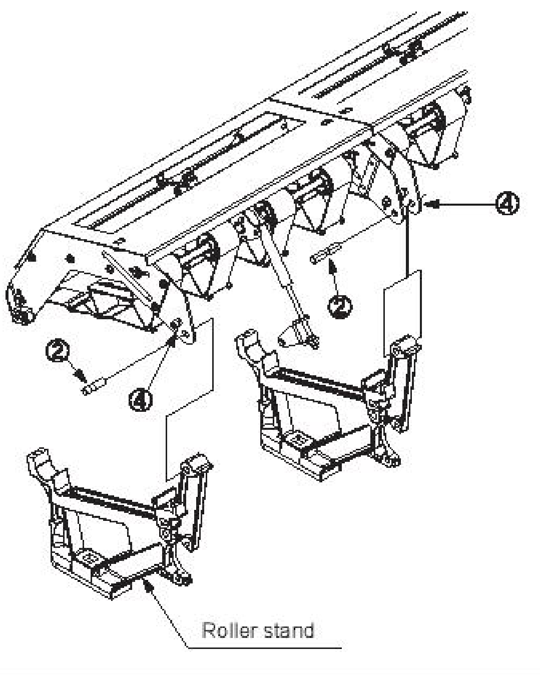
(1) Setting the cloth guides to the top clearers
Cloth guides ① are set to the optimum positions on the top clearers at TOYOTA when delivered if the roller gauge is predetermined. If you modify the roller gauge, move the cloth guides into place.

Cloth Guide on the Top Clearer



(2) Installing the top clearers to the FL
After setting the cloth guides to the top clearers, install each assembly to the FL by inserting hinge pin ② through the hole provided in the clearer bracket to support clearer frame ④ at its each side.

Installing the Top Clearers



(3) Bottom clearer's cloth guide types and mounting position

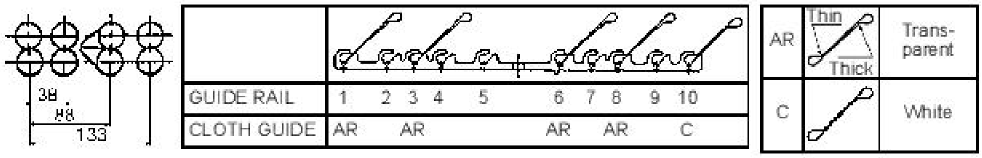
The cloth guides on the bottom clearer are available in two types. Both types are fitted and secured in the groove provided in the mounting base.

Depending upon the roller gages of the front rollers and back rollers, change the installation position of the cloth guides.

Drafting system		4-roller, D type							
Cradle model		OH514				OH534			
Staple length		Up to 38 mm				40 to 51 mm			
Cloth guide mounting position and type * in relation to roller gage		Sliver	Front to second rollers	Front to third rollers	Front to back rollers	Sliver	Front to second rollers	Front to third rollers	Front to back rollers
	Roller gage	Cotton	35 to 40	82 to 102	127 to 138	Synthetic fiber 44 mm	46 to 50	101 to 120	150 to 175
	Cloth guide		1AR, 3AR	6AR	8AR, 10C		1AR, 4AR	7AR	8AR, 10AR
	Roller gage	Blending 38 mm	40 to 43	91 to 102	141 to 158	Synthetic fiber 51 mm	53 to 55	113 to 120	Up to 185
	Cloth guide		1AR, 3AR	6AR	9AR, 10C		1AR, 4AR	7AR	8AR, 10AR
	Roller gage	Synthetic fiber 44 mm	46 to 50	101 to 120	150 to 175	Synthetic fiber 51 mm	53 to 55	113 to 120	185 to 193
	Cloth guide		1AR, 4AR	7AR	8AR, 10C		1AR, 2AR	5AR	8AR, 10AR

*Explanation of symbols for cloth guide mounting position and type

(Example) OH514 (staple length: up to 38 mm)
Front to second rollers : 38 mm
Front to third rollers : 88 mm
Front to back rollers : 133 mm



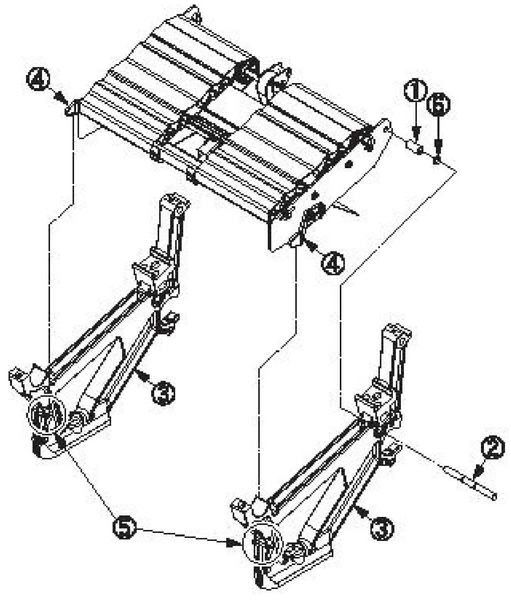
Drafting system		3-roller					
Cradle model		OH534			OH524		
Staple length		40 to 51 mm			64 to 76 mm		
Cloth guide mounting position and type * in relation to roller gage		Sliver	Front to middle rollers	Front to back rollers	Sliver	Front to middle rollers	Front to back rollers
	Roller gage	Synthetic fiber 51 mm	60 to 65	120 to 135	Synthetic fiber 64 mm	76 to 85	150 to 175
	Cloth guide		1AR, 2AR, 5C 1AR, 2AR	6AR, 10C 6AR, 8C, 10C		1AR, 3AR	6AR, 8C, 10C
	Roller gage	Synthetic fiber 51 mm	60 to 65	125 to 150	Synthetic fiber 76 mm	83 to 95	168 to 180
	Cloth guide		1AR, 2AR	6AR, 9C, 10C		1AR, 3AR	6AR, 9C, 10C

■ **Change the cloth guide position in the following cases:**

1) If the ends of the cloth guides are positioned just beneath the fluted rollers, the cloth might be dragged by the fluted rollers and rotated due to the increased contact pressure between the cloth and fluted roller. To prevent that, if you modify the roller gage for fiber specification change, change the cloth guide position referring to the above tables.

2) If the cloth contact pressure against the rollers is too low, fibers may wind around those rollers. To prevent that, change the position of the cloth guides to keep them near the rollers.

Bottom Clearer

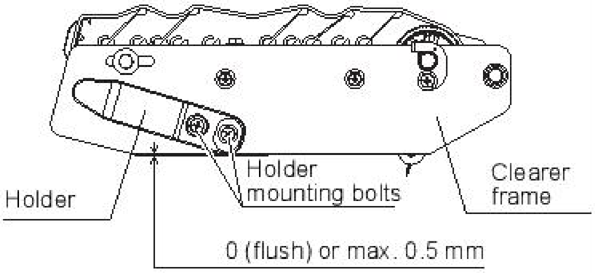


(4) Installing the bottom clearers to the FL

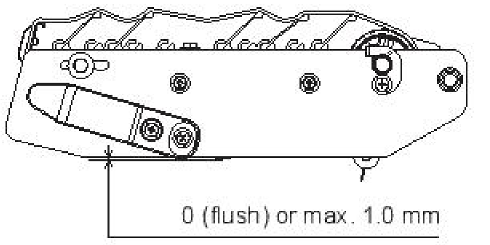
1) First, check that holder ④ is secured to specified position of the clearer frame ③.

Holder Mounting Position

- If the front roller diameter is 28.5:


Holder
Holder mounting bolts
Clearer frame
0 (flush) or max. 0.5 mm

- If the front roller diameter is 31.75:

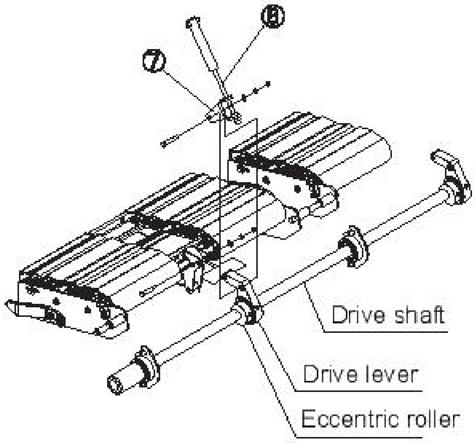

0 (flush) or max. 1.0 mm

2) Fit support pin (hinge pin) ② into the hole provided in the back frame of the roller stand, then set collars ① to both ends of support pin ②.

3) Install clearer frame ③ on the support pin ②. At this time install O rings ⑥ in the groove portions of the pin from both sides of the stand.

4) Put the end of holder ④ provided on the front end of the clearer onto mounting seat ⑤ on the roller stand.

Connection with the Drive Mechanism



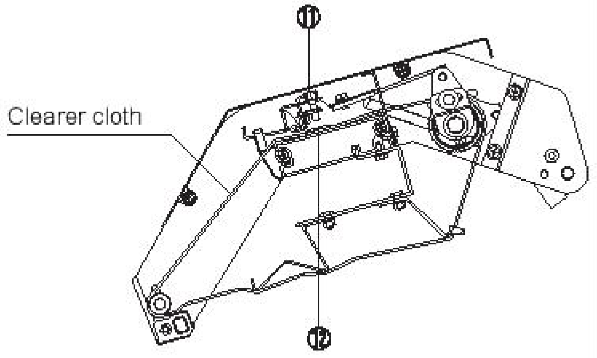
(5) Connection with the drive mechanism

1) As shown at left, connect the ratchet lever of each bottom clearer with the drive lever.

2) Connect bracket ⑦ of each top clearer with the drive lever.

(6) Adjusting the top clearer comb position
Adjust the sliding range of the top clearer combs by modifying the tightening position of the nut of joint rod ⑧.
Refer to (7) below.

Top Clearer Comb



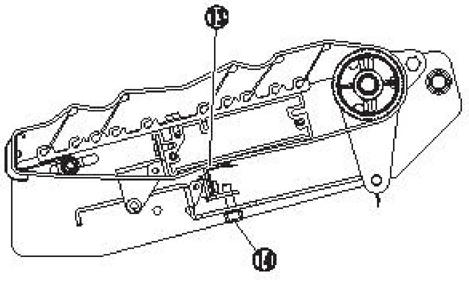
(7) Adjusting the top clearer comb angle
Adjust the angle of top clearer comb ⑫ relative to the clearer cloth by rotating socket bolt ⑪ with an Allen wrench (5 mm).

When the clearer cloth is new, set the comb angle so that the tip of the comb is a little away from the clearer cloth, preventing the comb from pushing into the clearer cloth.

When the clearer cloth has lost fluff on the surface, slightly turn up the comb.

NOTE: Do not turn up the comb excessively. Otherwise, the comb may push into the clearer cloth, resulting in a deadlock.

Bottom Clearer Comb



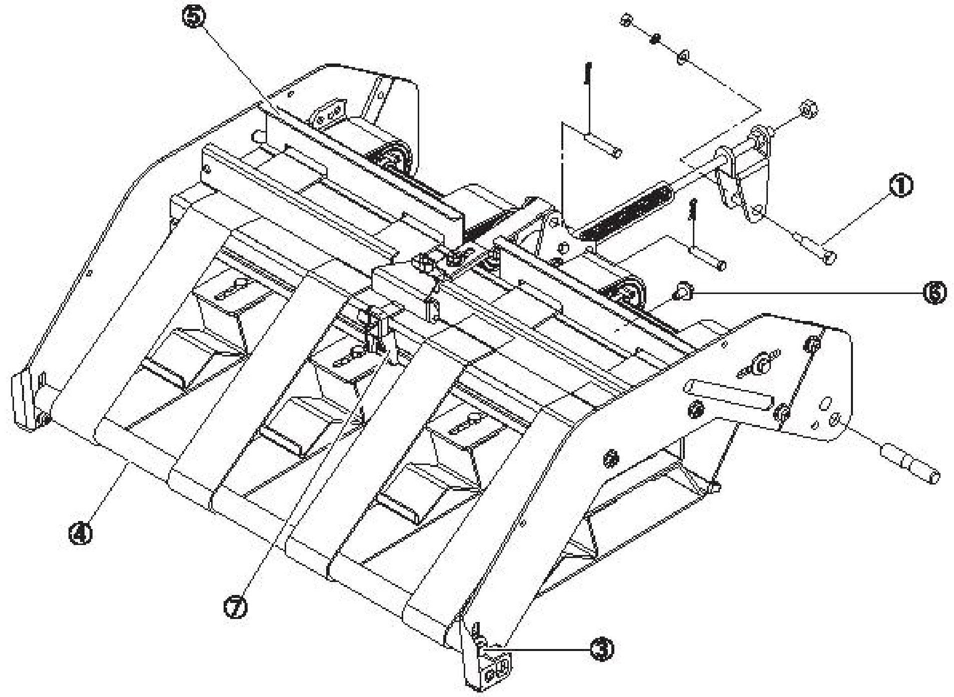
(8) Adjusting the bottom clearer comb angle
In the same manner as for the top clearer comb, adjust the angle of bottom clearer comb ⑬ relative to the clearer cloth by rotating the socket bolt ⑭ with an Allen wrench.

[2] Replacement of Clearer Cloths

If it is necessary to replace the clearer cloths due to stains, follow the procedures below.

(1) Replacing the Top Clearer Cloths

1) Take out the top clearer assembly from the FL according to the steps below.
   - Remove pin ①.
   - Loosen the set screw of pin ②, then shift the pin to take off the clearer.
2) Remove bolt ③ and take off front guide ④.
3) Remove screw ⑥ from the rear face of back clearer hopper ⑤, then take off the back clearer hopper.
4) Remove comb guide⑦.
5) Replace the top clearer cloth.



(2) Replacing the Bottom Clearer Cloths

1) Take out the bottom clearer assembly from the FL.

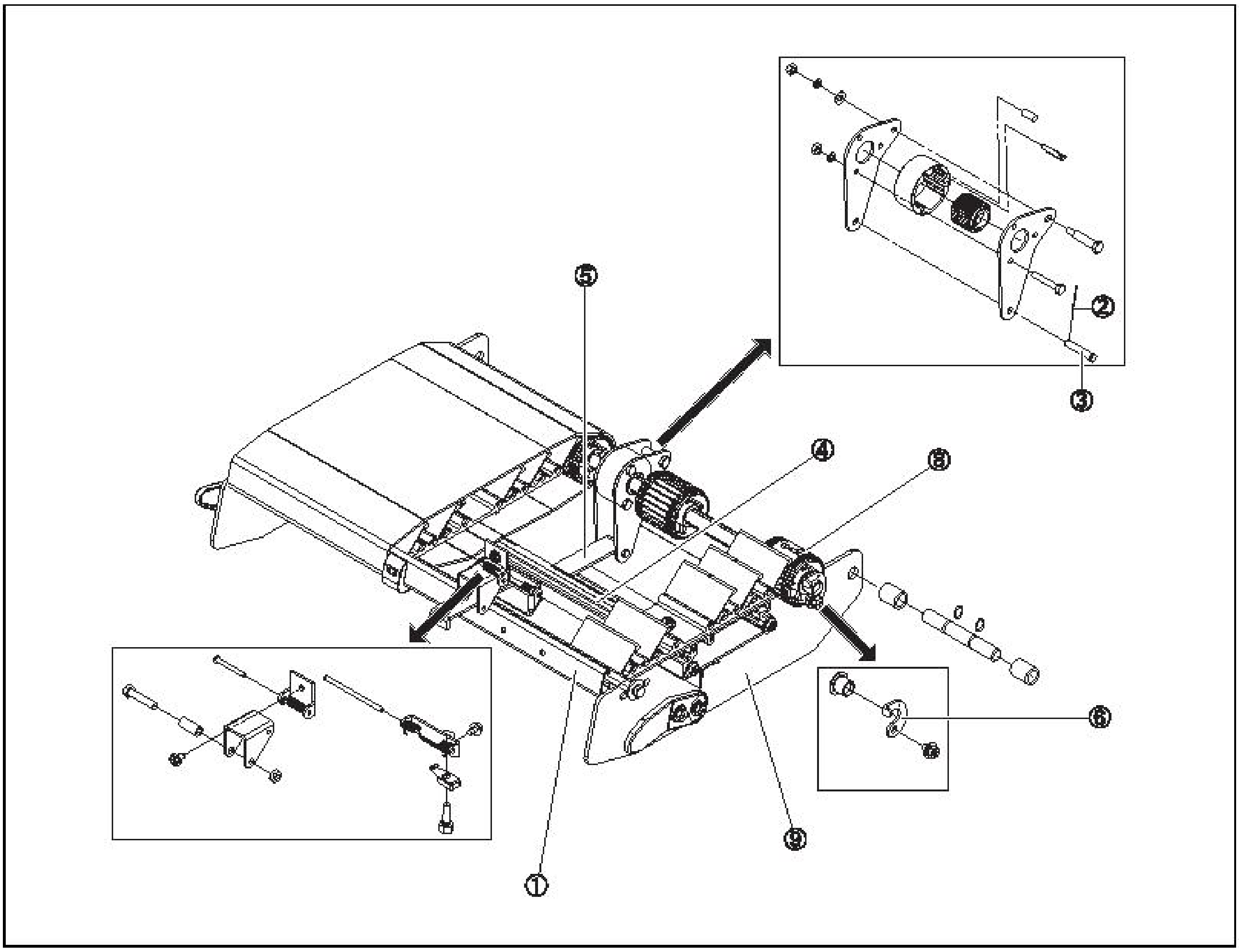
2) Turn front apron guide ① down towards you (when viewed from the front of the clearer).

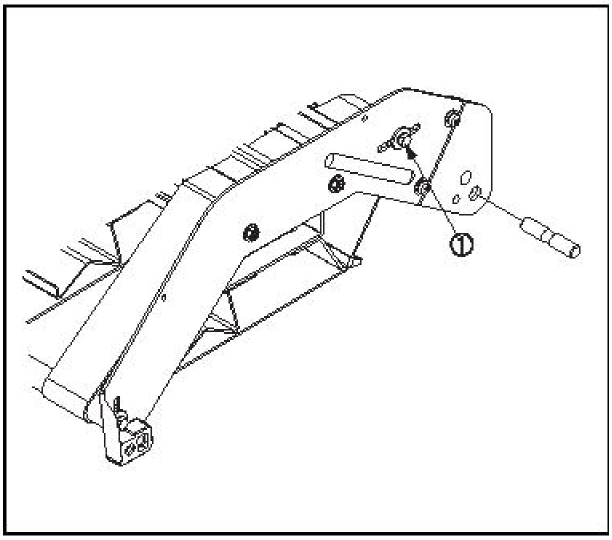
3) Remove snap pin ②, pull out hinge pin ③, and then take out comb bar ④ together with comb relay arm ⑤.

4) Remove bolt ⑦ which secures back roller stopper ⑥, then take off the back roller stopper.

5) Take out back roller ⑧.

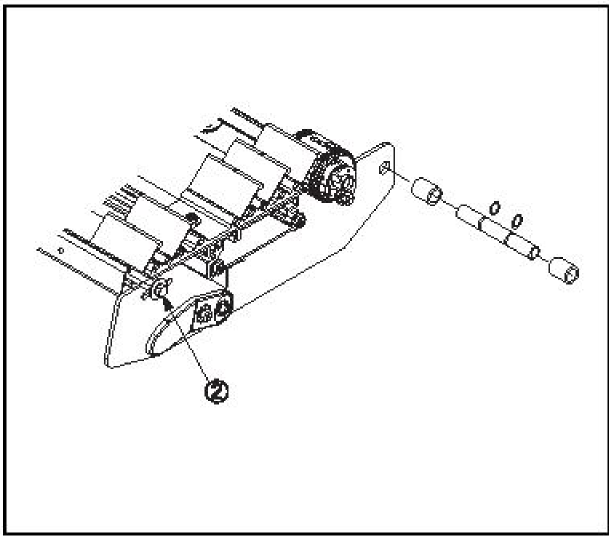
6) Replace the bottom clearer cloths, one by one from the cloth closest to inside frame ⑨.





(3) Adjusting the Clearer Cloth Tension
After replacement of clearer cloths, adjust their tension if necessary.

1) Top clearers
Loosen bolt ① which secures the back clearer roller, then adjust the position of the roller.



2) Bottom clearers
Loosen bolt ② and adjust the position of the guide rod.

[3] Maintenance for Top and Bottom Clearers

(1) Top clearers

1) For the FLs without BS cleaners or TRD-driven fleece collection
It is necessary for the operator to remove clearer waste gathered by the combs at least every time of doffing. Depending upon the amount of clearer waste accumulation, shorten the cleaning interval.

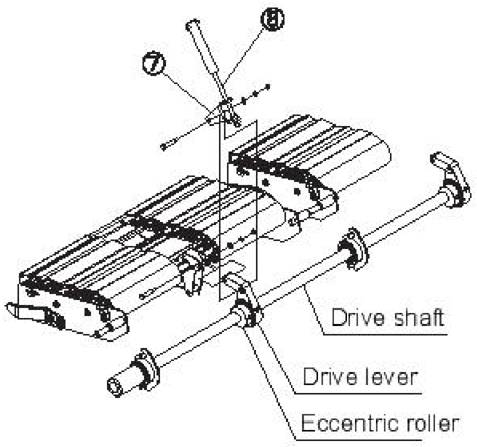
2) For the FLs with BS cleaners or TRD-driven fleece collection
When checking the comb state once a day, remove clearer waste gathered around spindles.
For waste accumulated inside the clearers, determine the cleaning interval and clean the inside of the clearers.

(2) Bottom clearers
The pneumatic suction system or the cross flow fan automatically takes in fleece gathered by the combs.
However, if fleece accumulates inside the bottom clearers (particularly the rotary sections), the clearers will not work effectively. Determine the cleaning interval and clean the inside of the clearers.

(3) Lubrication
Apply oil to the drive lever shown at left via the lubrication hole.

Lubrication intervals : Every 200 hours	
Lubricant : Lubricant B	

Connection with the Drive Mechanism



M.3.5 Blower Fan

The blower fan uses double-shielded ball bearings requiring no lubrication.
The runner is strictly adjusted and well-balanced in the factory. Dust or foreign materials accumulating on the runner will lose the balance, causing vibration when the blower fan works and resulting in a broken fan.

To prevent it, clean away dust or foreign materials from the fan periodically.

■ Disassembling

(1) Loosen six hexagonal bolts ① and remove casing ②.

(2) Loosen the screws on the boss of impeller ③ and remove the impeller.

(3) Remove guide vane ④.

(4) Loosen the screws on the boss of impeller ⑤ and remove the impeller.

(5) Clean away dust or foreign materials accumulating on the impellers and guide vane.

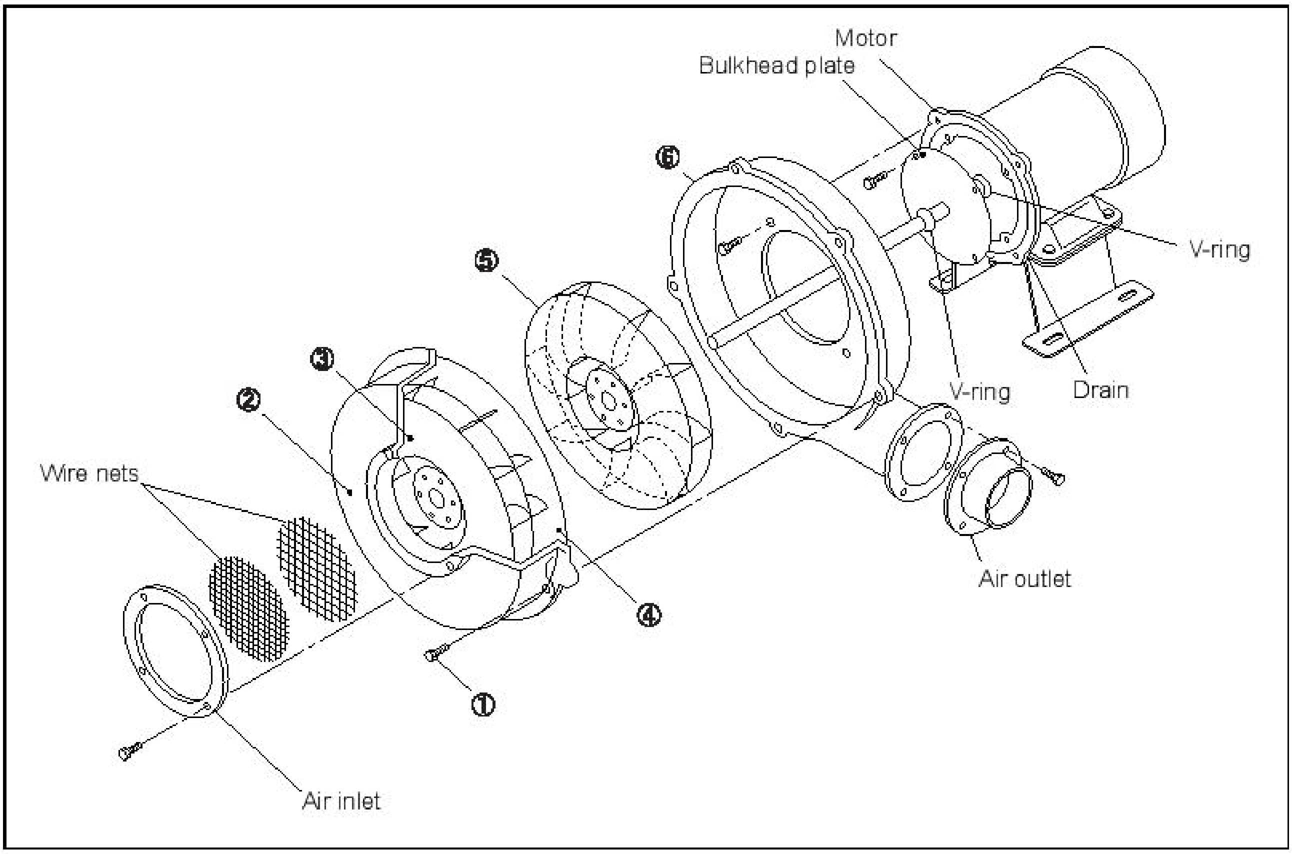
■ Reassembling

(1) Set impeller ⑤ onto the motor shaft so that the screws on the boss of impeller come into contact with the screw holes provided in the motor shaft, and then tighten those screws.

(2) Set guide vane ④ in casing ⑥.

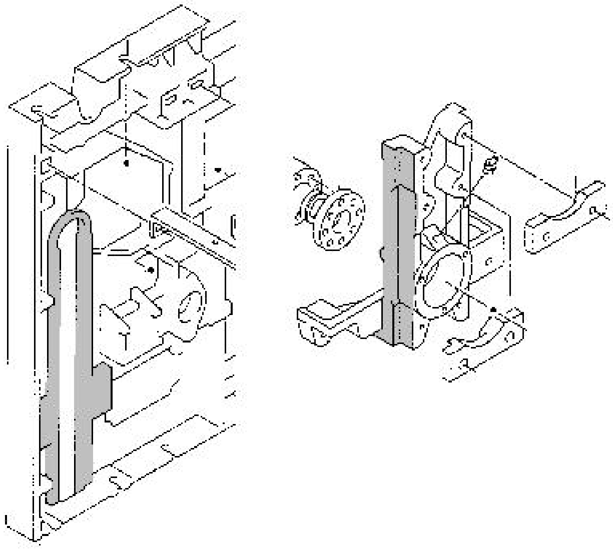
(3) In the same way as for impeller ⑤, set impeller ③ onto the motor shaft.

(4) Install casing ② and tighten six hexagonal bolts ①.



M.3.6 Maintenance of GE Lifter Rack

Smooth up- and down-movement of the bobbin rail is important in forming bobbins. Particularly, the GE lifter rack and its related sections have a great influence on bobbin formation, so daily inspection of them is essential.
If any chattering is found at the GE side of the bobbin rail, the GE lifter rack is broken, or any other problem occurs, then make the following inspection and maintenance.

No.	Check	What to do
1	Is any galling found on the slideways of the inside frame and the GE slide of the bobbin rail? 	If yes, grind the slideways with a fine file and sand paper (depending upon the degree of galling) to remove galling.
2	Does the slideways run out of lubricating grease?	• Remove fly, fleece and foreign materials and clean the slideways. • Apply the specified lubricating grease at the specified intervals. Molykote grease BR2, every week
3	Check the backlash between the GE lifter rack and the pinion. Is it appropriate?	If no, adjust the backlash at the uppermost and lowermost positions of the bobbin rail to 0.1 to 0.2 mm.
4	Is the bobbin rail GE level lengthways? Measure the height of the bobbin rail from the underside of the flyer rail. The height variation should be within 0.5 mm per bobbin rail piece.	If no, adjust the bobbin rail height so that its variation comes within 0.5 mm.

M.3.7 LUBE Electric Centralized Lubrication System

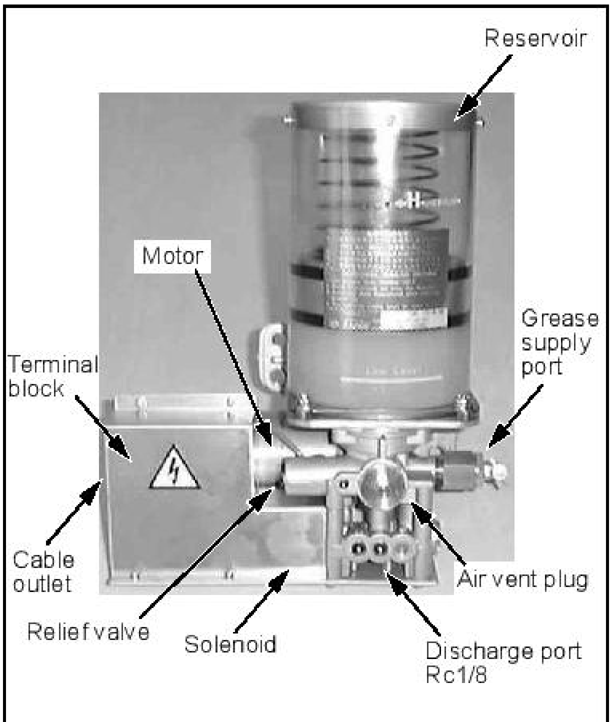
[1] Outline

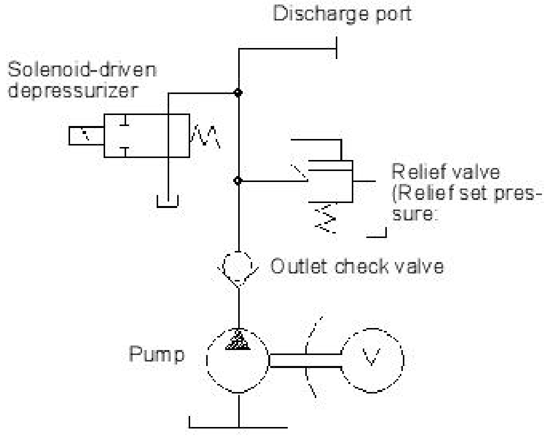
This system is composed of a motor-driven pump (EGME-10S-4-8P), piston valves (MG) and pressure switch. The pump pressurizes grease to feed it into the pipes. As the in-pipe pressure increases, the piston in each connected valve moves inwards so as to supply the specified amount of grease to the lubrication point. The pressure switch detects the in-pipe pressure change, signaling that grease has been discharged.

When the pump stops pressurizing grease, the in-pipe pressure automatically decreases so that the piston moves back to the retracted position. This retracting stroke of the piston will take in grease (which will be supplied at the next discharge stroke of the piston) into the valve.

The above operation could easily receive a serious influence by dust, fly, and air bubbles if coming into grease. Those foreign materials will cause pump or valve problems; in the worst case, they will result in a damaged weaving machine. Always observe the precautions given in item [3].

[2] Specifications of Lubrication Pump and Distributing Valves

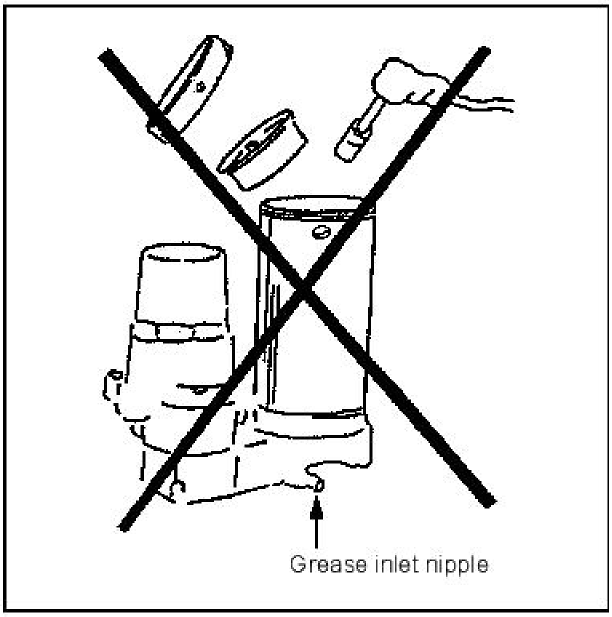

Reservoir
Motor
Grease supply port
Terminal block
Cable outlet
Air vent plug
Relief valve
Solenoid
Discharge port Rc1/8


Discharge port
Solenoid-driven depressurizer
Relief valve (Relief set pressure:
Outlet check valve
Pump

(1) Lubrication pump
This pump is driven by the motor to reciprocate the piston.

Model	EGME-10S-4-8P
Discharge rate	10 cc/min.
Discharge pressure	10 MPa (102 kgf/cm^2) (Relief set pressure)
Pressure relief mechanism	Solenoid
Reservoir capacity	800 cc
Rated voltage of electric motor	24 VDC, 2A

(2) Pump operation
When the power is turned on, the motor in the pump runs to start discharge. The solenoid is also energized to close the grease return port. Grease is fed forcibly into the tank. When the pipe internal pressure exceeds 10 MPa, the motor stops and the solenoid is de-energized to open the grease return port. Thus the grease in the pipe returns to the tank and the pipe internal pressure drops. (When the pipe internal pressure rises to 3 MPa, a fixed amount of grease is discharged from each MGA valve. When the pipe internal pressure drops to 1.2 MPa, each MGA valve is closed.)



IMPORTANT

[3] Precautions for Supplying and Storing Grease

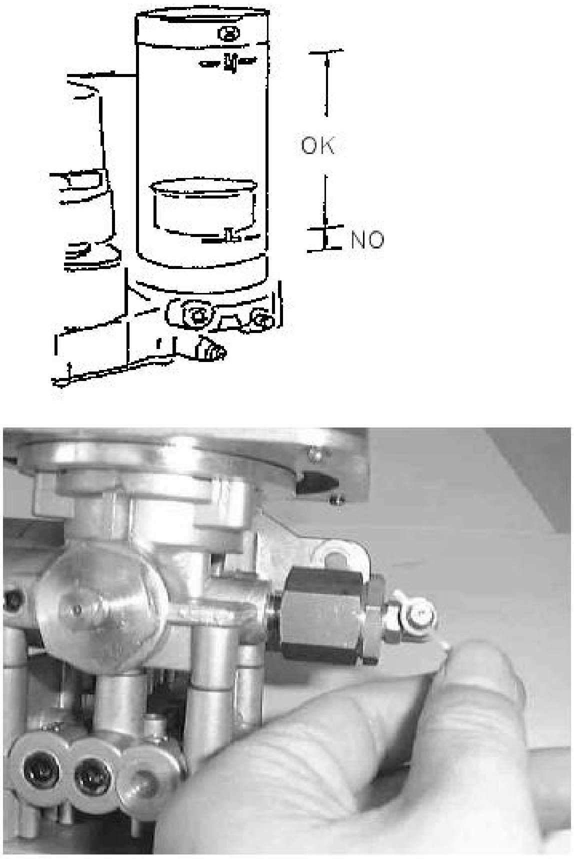
(1) Supply grease to the reservoir through the grease inlet nipple provided beneath the pump. Never remove the cap on the reservoir top to supply grease. This is to prevent foreign materials, fly, or dusts coming into grease.

- At the time of supplying grease, wipe the grease inlet nipple and the lubricating tools (particularly, those nozzle ends) with a clean cloth.
- If air bubbles get into the reservoir at the time of grease refilling, the pump will no longer work. After refilling, be sure to vent air bubbles from the reservoir according to the instructions given in [4] Periodical Inspection, (2), step 7).

(2) Use TOYOTA-recommended lithium-based greased No. 1 only. Never mix different brands of grease.

NOTE: Do not use calcium-based grease which is easily separated into base oil and soup base. The separated soup base will turn into sludge, accumulating inside the pump and causing pump malfunction.

NOTE: Do not use No. 2 grease which is hard and has very low flowrate. Using such grease will prevent the lubrication system from working normally.



(3) Before the grease level comes down to the low level (marked with = L = on the side of the reservoir), be sure to supply grease.
Operating the pump with grease less than the low level will make air bubbles come into grease, causing operation problems. In such a case, purge air bubbles, referring to item [4] Periodical Inspection, (2), step 7).

(4) Carry out the periodical inspection of the pump semiyearly.

(5) Check the piping for damage after doffing.

(6) Be sure to wash these pump filters every six months.

⚠ CAUTION

IMPORTANT

If dust, fly, or air bubbles get into the centralized lubrication system, it could result in a damaged pump or distributing valves.

Seal up the lubricant containers to prevent dust or fly coming into grease, and store them in an environment which is not subject to direct sunlight or extremes of temperature.

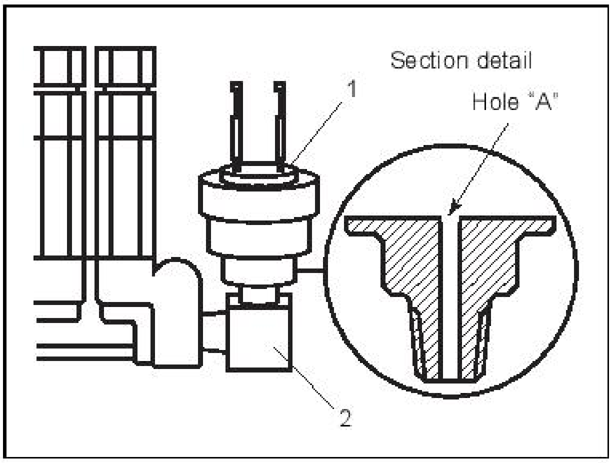
[4] Periodical Inspection

(1) The lubrication system requires the following periodical inspection:

1) Cleaning the pressure switchYearly

2) Cleaning pump filtersEvery 6 months

3) Checking the MG valve operation
Every 6 months
(Run the pump and check that grease comes out from all valves. If no grease comes out from any valve, disassemble the valve and wash it. Refer to [4], (2), steps 3) to 6).

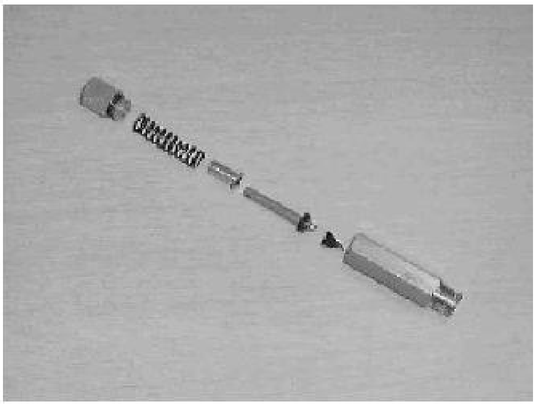


(2) Disassembly and washing procedure

NOTE: Never disturb the relief valve in the pump which has been adjusted before shipment.

1) Remove pressure switch 1 from T-shaped connector 2, and then remove grease accumulated inside the screw hole provided in the top of the thread.

2) Wash filters.
(Refer to Section M.2.2 [4].)



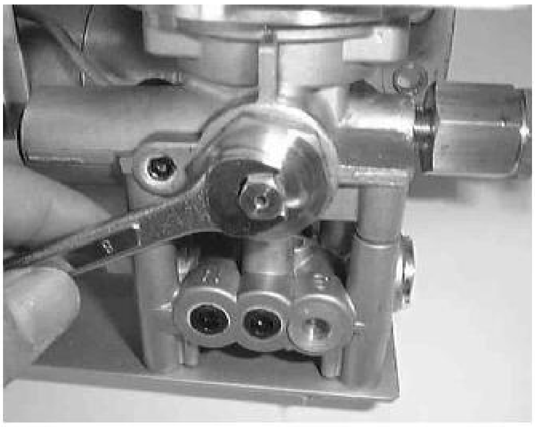
3) Remove the MG valve from the junction.

4) Gently take out the spring and other parts from the nipple of the MG valve, taking care not to let them jump out.

5) Wash the parts of the MG valve with kerosene.

6) Assemble the parts of the MG valve as shown at left, and then set them to the junction.

NOTE: Take care not to set the V packing at an angle.



7) After completion of reassembly and grease refilling, be sure to purge air bubbles out of grease.

- Purging the inside of the pump
  Loosen the air-bleeding plug on the pump by about one counterclockwise turn with a wrench.
  Operate the pump.
  Air and grease will come out from the hole at the tip end of the plug.
  Stop the pump when no air is mixed in the grease any more.
  Tighten the air-bleeding plug by turning it clockwise.
- Purging the inside of the pipe
  Remove the plug located at the end of the main piping, then operate the pump several times until air bubbles inside the pipe come out completely. After purging, tighten the plug until it comes to the original position.

[5] Troubleshooting

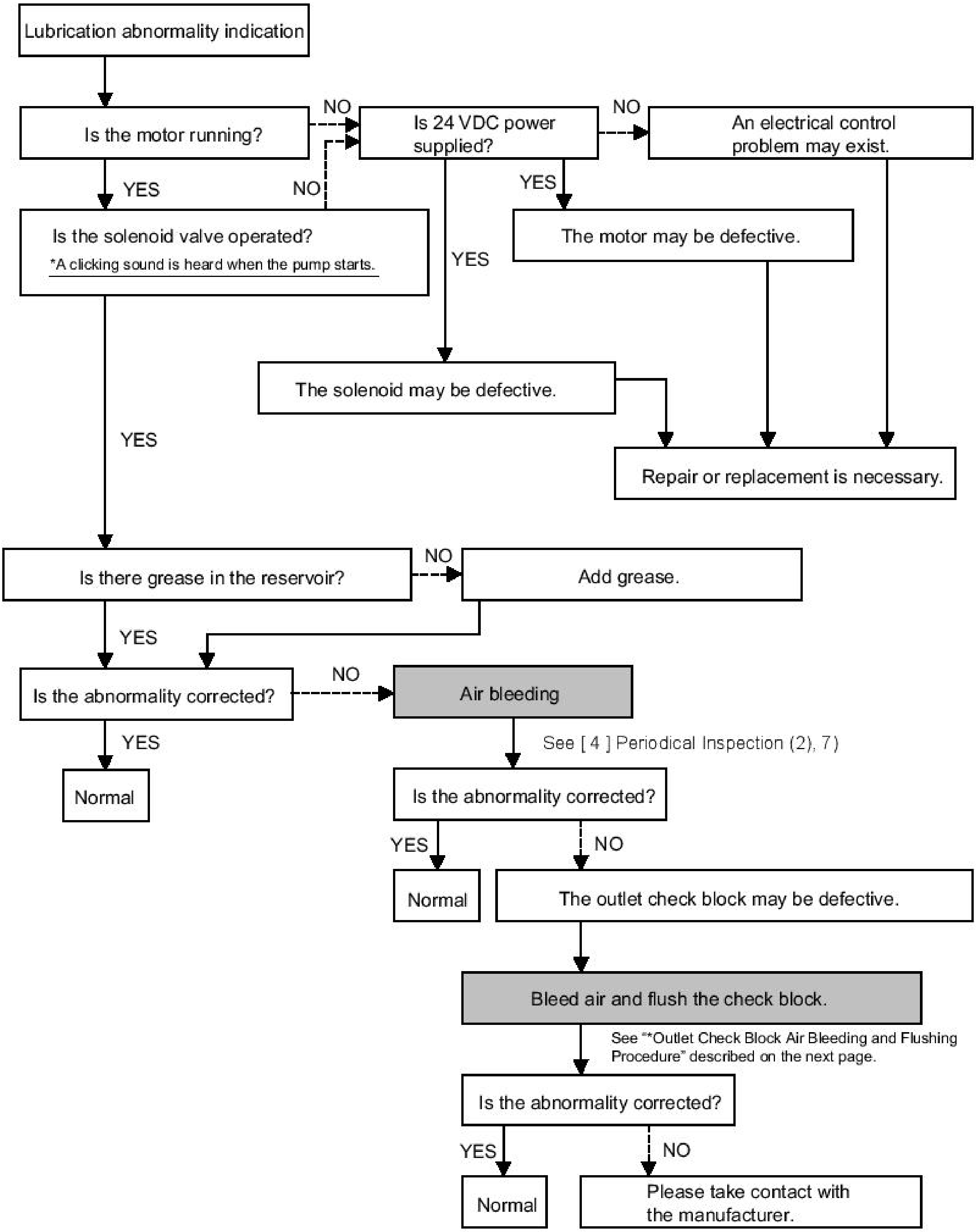
(1) If any error message appears on the function panel (refer to Subsect. 8.1.1 [2] [2.5], [2.6]):

Display on the function panel
E-17 Grease Pressure remain Low
E-18 Grease Pressure remain High

(2) Other problems

Refer to the troubleshooting flows (pump and piping) and take necessary actions.

1) Troubleshooting (pump)


Lubrication abnormality indication
Is the motor running?
NO
Is 24 VDC power supplied?
NO
An electrical control problem may exist.
YES
NO
YES
Is the solenoid valve operated?
*A clicking sound is heard when the pump starts.
The motor may be defective.
YES
The solenoid may be defective.
YES
Repair or replacement is necessary.
Is there grease in the reservoir?
NO
Add grease.
YES
Is the abnormality corrected?
NO
Air bleeding
YES
See [4] Periodical Inspection (2), 7)
Normal
Is the abnormality corrected?
YES
NO
Normal
The outlet check block may be defective.
Bleed air and flush the check block.
See "*Outlet Check Block Air Bleeding and Flushing Procedure" described on the next page.
Is the abnormality corrected?
YES
NO
Normal
Please take contact with the manufacturer.

* Outlet Check Block Air Bleeding and Flushing Procedure

- Take this action when the abnormality is not solved by air bleeding only.
- Take this action when a discharge trouble due to air or foreign matter entrance in the discharge mechanism is suspected.

■ **Phenomenon:**

The abnormality is not corrected by bleeding air from the air-bleeding plug. Grease comes out from the pump but the pressure does not rise.

■ **Corrective action:**

a. With a wrench (25 mm), loosen the plug at the output check block.

b. Remove the plug carefully so as not to lose the spring on the reverse side of the plug.

c. Stop the hole at the check block of the pump with a finger, and operate the pump. Always hold the check ball inside when operating the pump.

d. If grease without mixed air comes out, the action is complete.

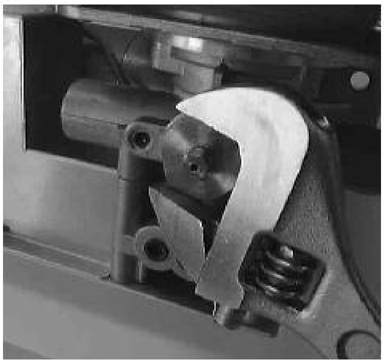
NOTE:

- Since a large amount of grease comes out, prepare waste cloth to prevent contamination around. Carefully operate to prevent loss of small internal parts.
- In step c. above, always hold the center before operating the pump. Otherwise, the internal check ball may be lost.

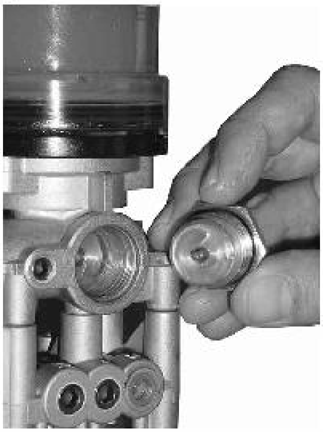
e. Fit and tighten the plug securely to the initial state.

f. Operate the pump again to check normal recovery without any leakage.

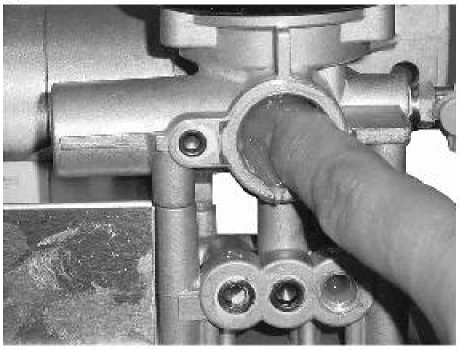
a.



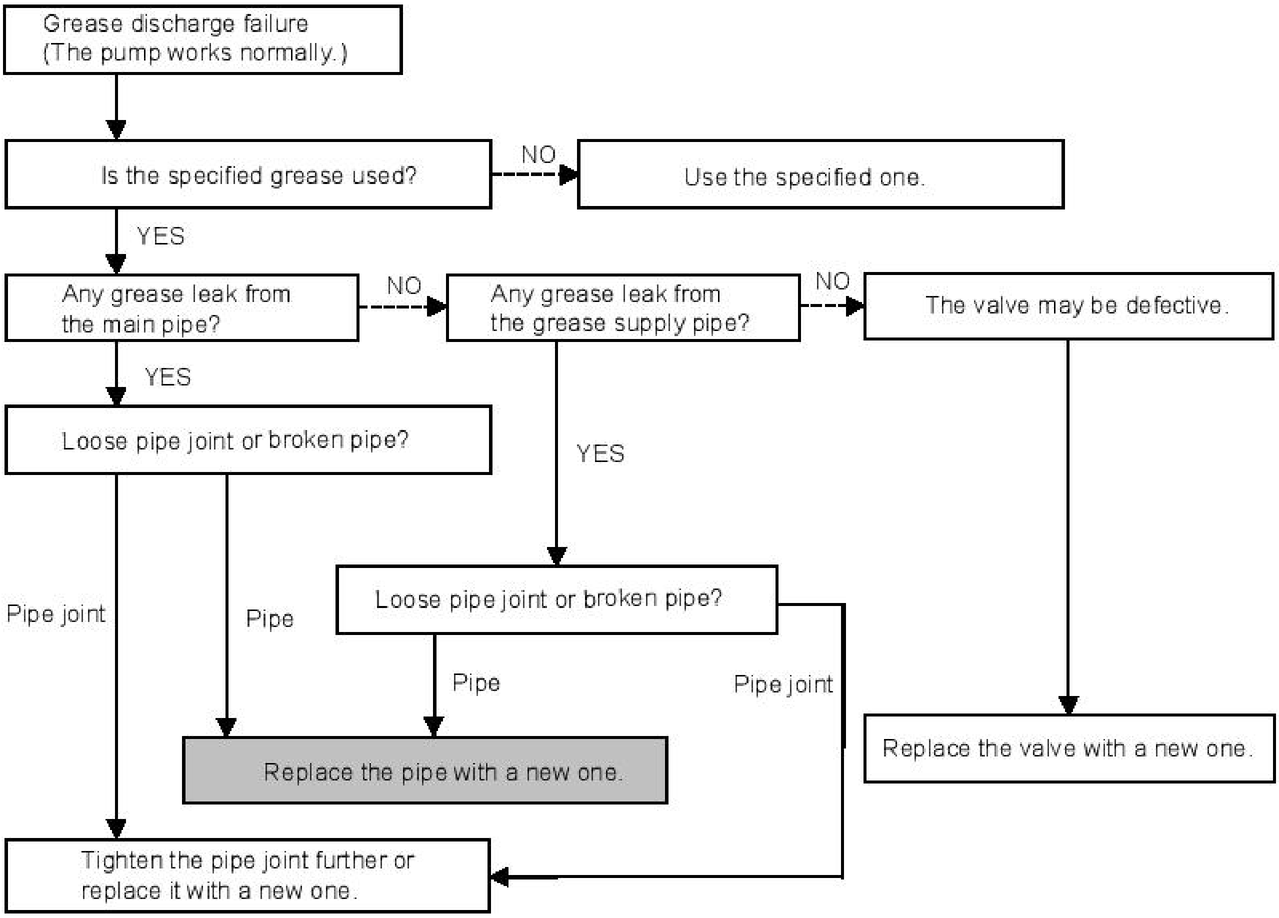
b.



c.



2) Troubleshooting (piping)


Grease discharge failure
(The pump works normally.)
Is the specified grease used?
NO
Use the specified one.
YES
Any grease leak from the main pipe?
NO
Any grease leak from the grease supply pipe?
NO
The valve may be defective.
YES
Loose pipe joint or broken pipe?
YES
Pipe joint
Pipe
Loose pipe joint or broken pipe?
Pipe
Pipe joint
Replace the pipe with a new one.
Replace the valve with a new one.
Tighten the pipe joint further or replace it with a new one.

Section S.1
Safe Work

S.1.1 Rules for Installation Work S.1-2
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S.1 Safe Work

Introduction

⚠ WARNING

⚠ CAUTION

There is no such thing as a perfectly safe machine. Incorrect usage or ignorance of rules of any convenient or useful machine possibly results in a serious bodily injury. in the worst case it could cause death and/or substantial property damage.

TOYOTA has made every effort to assure as safe work as possible, which cannot be completed, however, without your understanding and cooperation.

It was impossible for us manufacturer to provide this instruction manual covering all necessary information related to machine operation by taking into account the individual operating conditions at individual user sites. We, therefore, ask you to establish your own individual safety standards for each safe job of installation, operation, adjustment, and maintenance.

S.1.1 Rules for Installation Work

[1] Before Installation

(1) Confirm the safety rules and workmanship standards for the plant.

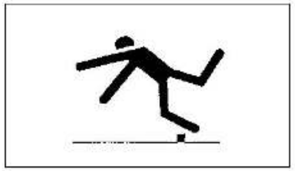
(2) Review the work contents and procedures beforehand by all staffs.

(3) For jobs requiring a group effort, choose a supervisor whose instructions should be followed thoroughly by all.

(4) For jobs requiring a group effort, agree beforehand by all staffs on words or gestures for giving and confirming signals.

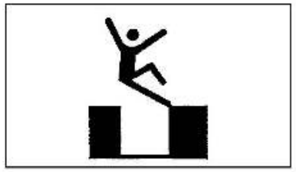
(5) Always wear safety shoes or sports shoes allowing easy operation.

(6) Check the work places and their surroundings. If any unsafe point is found, take the necessary action to make it safe.



FOR EXAMPLE:

1) When foundation bolts, power cable conduits and air inlet piping are spread out before installation, mark them clearly with brightly colored cloth or flags so that workers can avoid tripping or bringing the FL and carrying tolls into contact with them during carrying-in for installation.

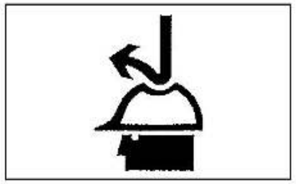


2) If there is any unstable footing due to any pits for exhaust, piping or wiring which is dangerously uncovered, put on a temporary cover to prevent falling accidents.

3) Use specified tools matched to the job to be done.

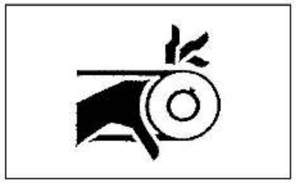
[2] During Installation

[2.1] General points for installation work



(1) Always wear a helmet whenever installation is being carried out at the same time as other jobs, such as construction and piping.

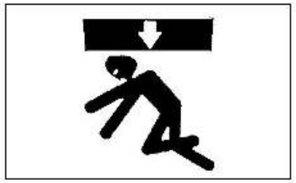
(2) Always wear gloves whenever there is the possibility of injuring hands or fingers.



(3) Never use gloves if there is the possibility of their becoming caught in rotating parts of the machine.

(4) Never get oil or grease on the floor, since these can cause slipping accidents.

(5) Always provide a stable platform or scaffold for those jobs in places too high to reach from the floor.



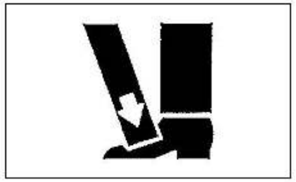
(6) Never climb onto a heavy hoisted object nor get under it, even a part of your body.

(7) Keep your tools, parts, devices and instruments neatly arranged, and observe the following rules:

1) Put them where they are not likely to fall down.

2) Whenever standing or leaning them against something else, do what is necessary to prevent them from falling over.

3) Whenever piling round bars or pipes, do what is necessary to prevent them from falling down.

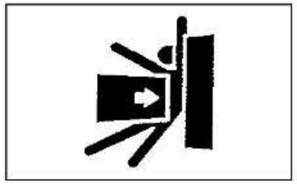


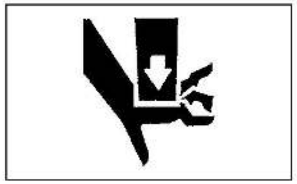
(8) Observe the following rules when conducting a group effort:

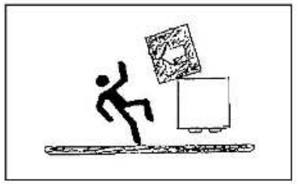
1) Choose a supervisor whose instructions should be followed thoroughly by all.

2) Send signals firmly and confirm them (for example, by repeating the signal).

3) Pay special attention when handling a heavy object. If the weight exceeds 20 kg, two or more workers should handle them.







[2.2] Transport

(1) Check out the transport route beforehand for thoroughly taking safety measures against obstacles, bumps or slopes.

(2) Before bringing in machinery, always prepare well-maintained carriers and other transport tools.

(3) Pay special attention when unloading the machinery from a truck.

(4) Never lift the load on the carriers any higher than 200 mm above the floor.

(5) Never stand in small spaces between the load and wall during transportation.

(6) Always assign a guide and transport according to his or her instructions. The guide should pay special attention to any protruded items in the transporting route.

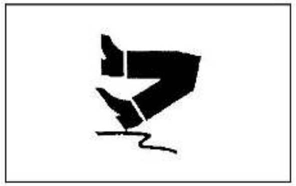
(7) Whenever inserting wooden blocks under the load, never let fingers get between the load and floor.

(8) Always push handcarts when carrying loads. Never pull them.

(9) Fix the load with ropes or other means if necessary, to prevent the load from falling down during transport.

(10) Always lift up the GE frame using ropes or belts from the front door side (as the center of gravity lies on the GE side as seen from the center) to prevent the frame from falling down.

(11) Long and/or heavy components such as the spring pieces, roller beams, flyer rails, bobbin rails, flyer shafts, and bobbin shafts are palletized or packed in boxes. When bringing these parts in with a forklift or cart, secure them with ropes as required to prevent them from damages caused by falling down.



[2.3] Unpacking and Cleaning

(1) Parts are coated with rust-preventive oil. Take necessary action so they will not slip when carrying them.

(2) When washing parts, use waterproof paper to prevent the floor from becoming stained.

(3) Use the New-sol Deluxe supplied by NIPPON OIL CORPORATION or an equivalent cleaning fluid. Never use trichloroethylene-base cleaning fluid; otherwise, the painting will peel off or discolor.

(4) Never place anything on the parts storage area, passages or footing areas. Never stack up spring pieces high beyond a few tiers.

(5) Pay sufficient attention to unpacked boxes, nails protruding from wooden plates, hoops and other packing materials so as not to step on them or hurt yourself with them.

[2.4] Handling Heavy Components

When handling heavy components as given below, work in a comfortable position. If the weight exceeds 20 kg, two or more workers should handle it.

GE head complete, OE frame, roller beam, flyer rail, bobbin rail, spring piece, etc.

[2.5] Handling Long Parts

(1) Long parts should be placed so that they will not fall over or down. If necessary, provide anti-slipping measures or protective fences to prevent dangers.

(2) Pay attention to the surroundings when handling long parts as given below. If one person is not enough, have two workers or more handle them.

Flyer shaft, bobbin shaft, Lifter shaft, fluted roller, traverse bar, feed roller, creel pillar, etc.

[2.6] Working in Low Positions

(1) When standing up after working with adjusting bolts in a low position, be careful not to get injured by a falling stretch or parallel ruler fall due to unexpected contact.

(2) When installing the bobbin rail, carefully operate to prevent your head from injury due to contact with the flyer rail.

[2.7] Assembly and Adjustment Work

(1) Rough assembly

1) When removing the GE head complete from the skid, communicate with your co-worker sufficiently to prevent your hands from being pinched.

2) When leveling spring pieces, work with another person as a team. One person should perform leveling while the other is holding a spring piece securely to prevent it from falling down.
Never try one-man operation in a difficult posture. Also carefully prevent a tool from falling during operation and movement.

3) Adopt a team operation for installing the heavy roller beam. Sufficiently communicate with the co-worker to prevent your hands from being pinched. Also pay attention to the angle in the footing area to prevent tripping.

(2) Flyer rail and bobbin rail installation

1) Adopt a team operation when installing the heavy flyer rail. Sufficiently communicate with the co-worker and prevent hand slipping.

2) Raise the bobbin rail GE slide to the center of the lift by operating the handle and support it with wooden blocks so as not to cause falling.

3) When installing the bobbin rail, check to see that the rail rib is securely seated in the jack groove and carefully operate to avoid accidents caused by tripping or falling.

(3) Operation on the rear side of FL

1) Since parts installation on the rear side of the FL requires working in a low or medium position in a narrow space, be careful so as not to let your head, upper body and head be injured.

2) When installing the balance spring on the FL200, carefully avoid pinching by in the expanded spring or injury at your head, upper body or hand by the released spring.

(4) Installing the roller parts

1) When connecting the rollers, fix the connecting tools securely with no danger of slipping, onto the fluted rollers.

2) When installing the bottom rollers onto the roller stands, do so as a team and assign a leader, clearly communicating with words or gestures.

3) After connecting the bottom rollers, fix the rollers to the roller stand with strings at intervals of two blocks to prevent the rollers from coming off in the subsequent operation (for removing distortion from the rollers).

(5) Installing the creel parts

Adopt a team work for all operations since the working posture is likely to become instable due to the high position. Also use sufficiently stable platforms.

(6) Wiring work

1) Never allow non-qualified workers to carry out connection or disconnection of the primary power lines.

2) Before starting wiring work, be sure to check that the main circuit breaker is open and the warning notice (tag) is put up for all to see.

3) Before starting wiring work, confirm that the power lines are not alive (the voltages are not applied).

4) Confirm that the ground wire of the plat power supply is connected to the PE terminal in the control box.

[3] Before Trial Operation

(1) Clear away bolts, nuts, tools and other unnecessary things around, on and under the FL.

(2) Check tightening of all FL parts and installation of safety covers.

[4] During Trail Operation

(1) Rotate the drive belts and chains on each of the drive sections manually to check for fraying, breaks or other damage. Make sure to communicate clearly with co-workers so that no one's hand becomes caught in running belts or chains.

(2) Check that all wirings and connections of the FL200 are correct without any abnormalities.

(3) Check the rotating directions of the main motor, CWC motor, blower motor, winding motor, lifting motor, drafting motor, and fan motor.

(4) Check that all stop motions and limit switches operate normally.

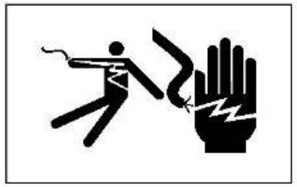
(5) When starting the FL200, clearly communicate your intention to co-workers, and wait for them to confirm it. Then, check that the FL200 starts and stops normally, in this order.

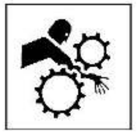
(6) When checking the rotation and abnormal noise of the driving shaft and flyer/bobbin wheel during operation, carefully operate so as not to bring your upper body and wear from coming into contact with the rotating flyer.

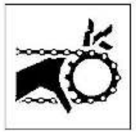
(7) When meshing together the change gears, be careful that your hands do not slip on the oily surface.

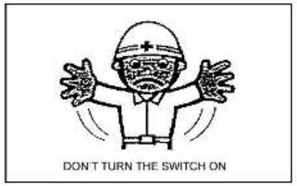
(8) When meshing the roller parts and creel gear, carefully avoid an unnatural posture because the working position is high. If operating on a stool, use a sturdy, stable one.

S.1.2 Rules for Safe Operation








DON'T TURN THE SWITCH ON

[1] General

[1.1] Absolute Precautions

(1) Never allow non-qualified workers to carry out connection or disconnection of the primary power lines.

(2) Never try any hot-line job when changing the wiring of the FL200.

(3) Never start the FL200 without communicating your intention to co-workers or without confirming their answer to your signal.

(4) Never touch rotating or operating parts unless the FL200 comes to a complete stop.

(5) Never operate the FL200 in clothes which could become entangled in the rotating parts.

(6) Never remove a warning notice, caution plate or instruction plate from the FL200, no matter what.

[1.2] Handling Abnormal situations

(1) Always turn the main circuit breaker of the FL200 off before making any adjustments or repairs to correct abnormalities found during operation.

(2) If you turn off the main circuit breaker of the FL200, be sure to put up the warning notice for safety specified in the work standard.

(3) A temporary warning notice should be removed only by the person who put it up, once it has become unnecessary.

[1.3] Other Precautions

(1) The supervisor should make sure that each employee sufficiently observes all safety rules.

(2) Observe the safety regulations enforced in the destination country.

[2] Precautions for Spinning Operation

[2.1] Starting

(1) Make sure that there is no one beside or behind the machine.

(2) When two or more workers are to handle the job, they must always communicate with words or gestures before starting up the machine.

(3) Before pressing any switches on the machine, be sure to identify them to prevent mistakes.

[2.2] During Spinning Operation

(1) No one other than the person in charge must take recovery action if any of the electrical parts in the control operates so as to cause the FL200 in operation to either stop or become non-workable.

(2) bserve the following precautions while the machine is in operation:

1) Never touch the running portion.

2) Never open or remove any of the safety covers.

3) Never try to remove yarn or fly.

(3) Do not operate the FL200 in the types of clothes given below:

1) Clothes that can be easily entangled by rotating parts (example: necktie)

2) Long sleeves with buttons

3) Work cloths with large buttons sticking out in front

4) Sandal-type shoes

(4) Never put scissors or tools in a non-flap breast pocket.

(5) Keep long hair up under your cap to prevent it from catching in the machine.

(6) Never restart the FL200 without permission if it is stopped by:

1) A person in charge of the machine

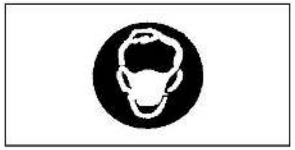
2) A patrol inspector

3) A person in charge of lubrication

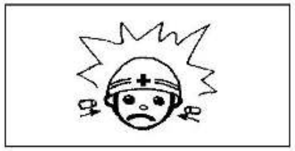
4) Other responsible persons

[2.3] Other Precautions

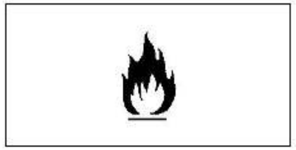
(1) When removing fly or fleece entangled around the top rollers, remove the top roller from the FL200 or hold it securely by a hand in a way it will not drop onto your feet or rotating parts even if it is disconnected.



(2) Put on a mask in the room when the machine is in operation. There will be a lot of invisible fly, fleece or yarn particles floating around.



(3) Put on a pair of ear plugs to protect your ears from noise when working around operating machines for a long time. When the FL200 is in operation, the noise level usually exceeds 70 dB (A).



(4) Be sure to clean the machine to prevent fire as follows:

- Periodically wipe off fly or fleece accumulating around the motors.
  Even if the thermal sensor is provided (to stop the machine when the motor exceeds a predetermined temperature), this is no excuse to neglect any cleaning.
- Periodically remove fly or fleece accumulating around the magnet switch and its surroundings in the control box, using a vacuum cleaner. Since the magnet switch will spark during normal operation, it could result in fire if fly or fleece accumulates around the magnet switch.

S.1.3 Rules for Maintenance Work

[1] Before Maintenance Work

[1.1] Checking the Work Procedure

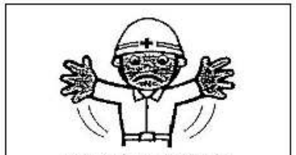
Check the work procedure with co-workers in advance. Be sure to inform the spinning operators that the FL200 is to be stopped and always put up the maintenance notice specified in the work standard on the power switch.

[1.2] Checking the Tools

Use spanners and wrenches suitable for the sizes and locations of bolts and nuts.

[1.3] Keeping Things Neat and Tidy

Determine the storage location for disassembled parts, making sure that passages are clear for frame operators.



DON'T TURN THE SWITCH ON

[2] Rules for Maintenance Persons

(1) If you stop the FL200 for maintenance, be sure to put up the warning notice indicating "DON'T TURN THE SWITCH ON."

(2) Never put tools or other items on top of the FL200, on the FL200 regardless of whether it is running or is stopped.
(Otherwise, they may fall into the FL200 to cause an injury or damaged parts.)

(3) Never use compressed air for cleaning your skin.
(The wound may be opened to cause infection.)

(4) Lubricant, paint, bond, sealing agent or detergent may damage skin or eyes. Always wear suitable protection gear such as safety gloves and goggles when using such materials.
If any of these come into contact with skin or eyes, wash them with water immediately and seek medical treatment.
When using any washing solution, always ventilate the room sufficiently.
Follow the instructions provided by the material manufacturer or supplier.

(5) For any job which could damage the eyes, e.g., cutting with a sander and drilling holes, always wear safety goggles.

[3] During Maintenance Work

[3.1] Maintenance Work

(1) Installing or Removing the Parts Inside the GE Assy

1) Since the GE assy incorporates a variety of automatic devices, be sure to stop the FL200 in the reference position, so that parts will not have to be forced in or out.

2) Parts can easily become slippery due to grease, oil, fly or fleece, so clean them off as thoroughly as possible and hold them securely, preventing dropping and injury.

(2) Installing or removing the motor pulleys, timing pulleys, and driving pulleys

1) When installing or removing the flat belts or timing belts, be careful not to get your hands caught in the belts.

2) Since the pulleys are heavy, install or remove them in a comfortable position.

(3) When adjusting the tape tension pulleys or contact pulleys during operation, make sure that your hand does not directly contact the dangerous rotating section, and work in a comfortable position.

[3.2] Lubrication Work

(1) Make sure to check that the machine has stopped before greasing of the bearings or gears.

(2) Always wipe up oil spilled on the floor after supplying oil to the oil bath.

(3) Waste oil drained from the oil bath should be disposed of in containers specified by the plant.

S.1.4 Rules for Handling and Inspecting Electrical Units

⚠ WARNING

> The capacitor, inverter, servo amplifier and control power supply board of the main circuit of the machine are charged, and they remain at a high voltage for a while after the main circuit breaker (CB1) is turned off. Any operation must be waited until you make sure that CHARGE LEDs of all inverters and servo amplifiers turn off after at least three minutes from turning the main circuit breaker off.
>
> Also, before starting an operation, measure the voltage of parts which may be touched and ensure safety.

(1) All operating and checking jobs of electrical devices must be carried out by persons with appropriate qualifications (e.g., duly trained persons or electrical engineers).

(2) Always turn off the main switch before opening the control box.

(3) After turning off the main switch, be sure to put up the warning tag "DON'T TURN THE SWITCH ON" on the main switch.

(4) Handle an electrical component or part only when no power is supplied to it. Note that the primary side terminals of the circuit breaker are applied with a voltage even when it is turned off.

(5) Voltage application may be needed for checking control system functions. Be especially careful when conducting such a job.

(6) Use the measuring devices and tools, all kept in proper condition.

(7) When connecting the power supply to the loom, always connect the protective wire (green or yellow/green spiral) first to the PE terminal. For disconnection, be sure to disconnect the protective wire last of all.

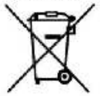
(8) During electrical installation work, the observer responsible for security of the workers must absolutely, without fail, attend at the field. The observer should be limited to someone with know-how concerning electrical troubles.

(9) Never try to modify an electrical unit or device because it may cause a malfunction or accident. If it is inevitable, please consult with us.

(10) Precautions for disposal of components
When disposing electrical components or wires, they should be separated from general garbage for disposal. Due caution is needed especially for disposal of items below.

1) LCD panels and backlight
The backlight, a component of the function panel, contains mercury.
Upon disposal, comply with applicable ordinances or regulations.

2) Batteries



EU Directives: 2006/66/EC
The symbol illustrated indicates the need for handling batteries (including accumlators) separately from general garbage for disposal.
Batteries (including accumulators) contain substances harmful to the environment and human body.
In case chemical symbols are displayed below the illustrated symbol, the battery (or accumulator) contains heavy metals above the standard concentration level.
The following is the standard:
Hg: Mercury (0.0005%), Cd: Cadmium (0.002%), Pb: lead (0.004%)

The machine being handled uses batteries (including accumulators), and therefore upon disposal, comply with applicable ordinances or regulations.

Section 1.1
FL Condition Setting

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[1] Gearing Diagram 1.1-2

[2] Gear Codes, Names and Specifications of Change Wheels 1.1-3

[3] Choosing the Total Draft Change Wheel (TDC) 1.1-4

[4] Choosing the Back Draft Change Wheel (BDC) 1.1-5

[5] Choosing the Number of Roving Layers 1.1-6

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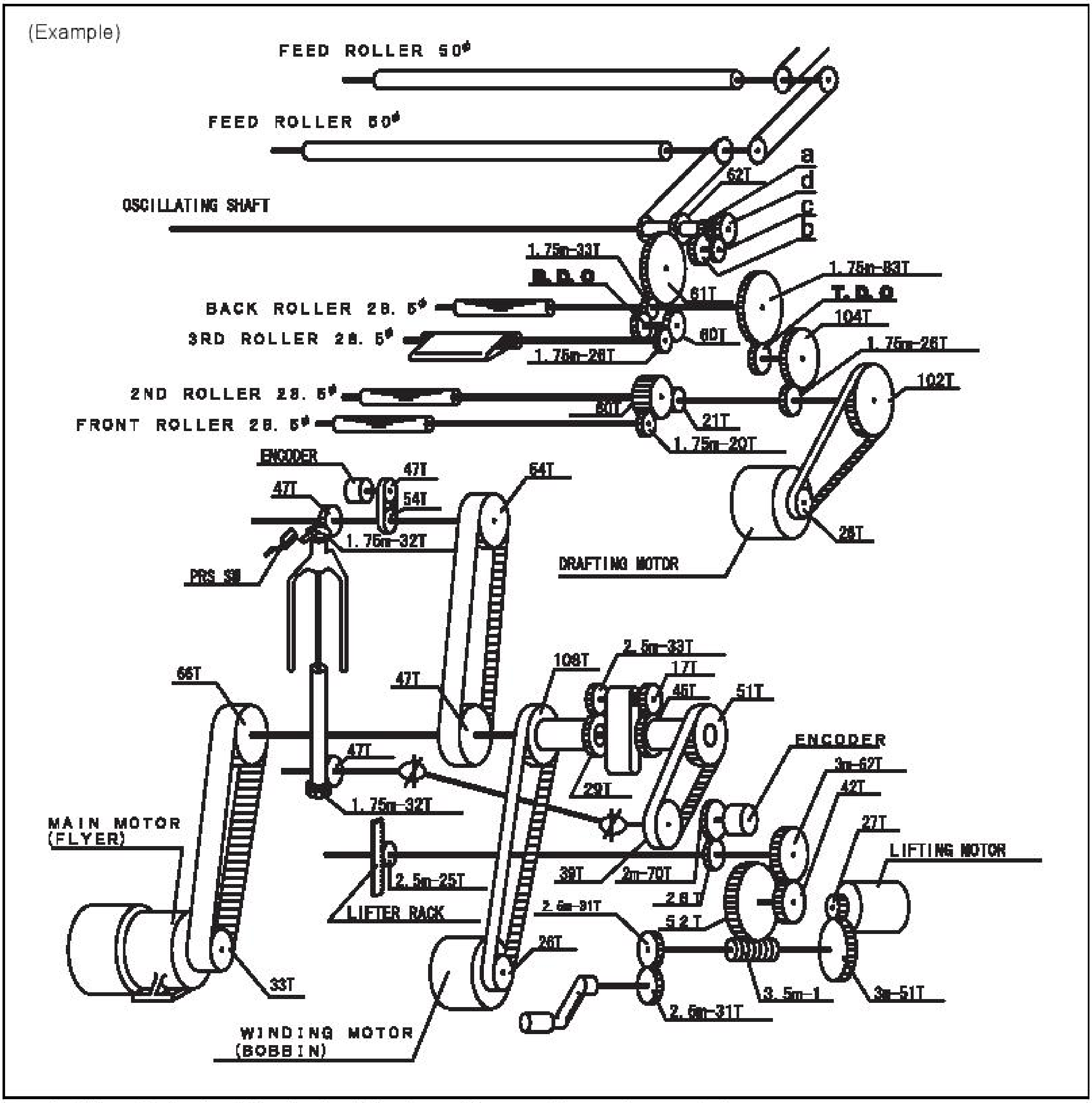
Machine Conditions 1.1-7

1.1 FL Condition Setting

1.1.1 Various Gearing Calculations

[1] Gearing Diagram


(Example)
FEED ROLLER 50φ
FEED ROLLER 50φ
OSCILLATING SHAFT
a
d
c
b
62T
1.75m-33T
B.D.G
61T
1.75m-83T
T.D.G
BACK ROLLER 28.5φ
3RD ROLLER 28.5φ
60T
104T
1.75m-28T
1.75m-26T
102T
2ND ROLLER 28.5φ
FRONT ROLLER 28.5φ
80T
21T
1.75m-20T
ENCODER
47T
47T
54T
54T
1.75m-32T
PRS SW
28T
DRAFTING MOTOR
66T
47T
108T
2.5m-33T
17T
45T
51T
47T
29T
1.75m-32T
ENCODER
3m-62T
42T
27T
LIFTING MOTOR
MAIN MOTOR
(FLYER)
2.5m-25T
LIFTER RACK
39T
2m-70T
26T
52T
2.5m-31T
26T
33T
3.5m-1
3m-51T
2.5m-31T
WINDING MOTOR
(BOBBIN)

For details, refer to the “Mechanical Equipment” manual issued separately.

[2] Gear Codes, Names and Specifications of Change Wheels

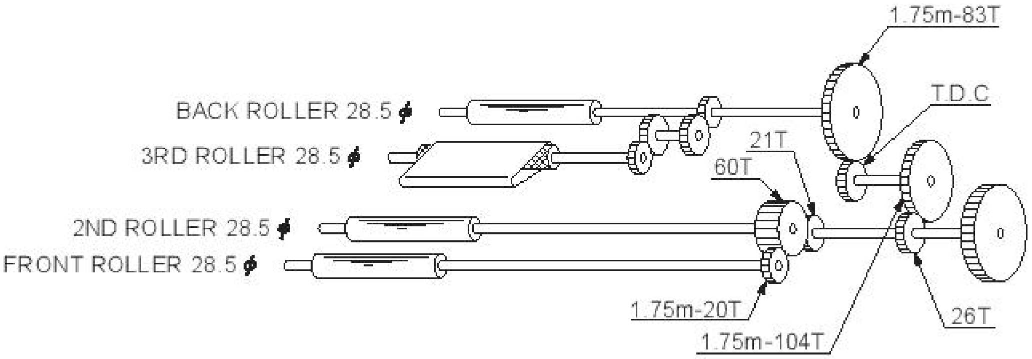
Code	Name of Change Wheels	Module	Allowable Number of Teeth	Actual Number of Teeth	Remarks
TDC	TOTAL DRAFT CHANGE WHEEL	1.75	26T to 71T	T	
BDC	BACK DRAFT CHANGE WHEEL	1.75	50T to 70T	T	
a	OSCILLATING DRIVE WHEEL	2	28T	T	
b	OSCILLATING DRIVE WHEEL	2	41T	T	
c	OSCILLATING DRIVE WHEEL	2	29T, 33T, 41T	T	c + d = 69T
d	OSCILLATING DRIVE WHEEL	2	40T, 36T, 28T	T	

Fill in the actual number of teeth on each of the change gears used in the FL.

[3] Choosing the Total Draft Change Wheel (TDC)

[3.1] Second Roller Drive (Specifications)

(1) Total draft gearing diagram


1.75m-83T
T.D.C
BACK ROLLER 28.5 ϕ
3RD ROLLER 28.5 ϕ
21T
60T
2ND ROLLER 28.5 ϕ
FRONT ROLLER 28.5 ϕ
1.75m-20T
1.75m-104T
26T

(2) Calculation formula

Total draft constant $= \dfrac{104 \times 83 \times 21}{26 \times 20} = 348.60$

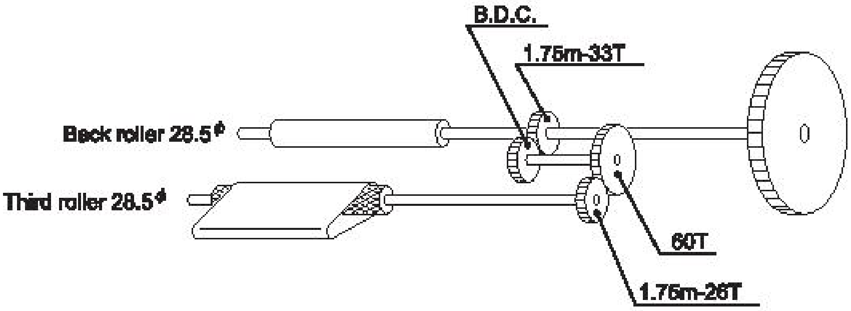
No. of teeth on total draft change wheel $= \dfrac{348.60}{\text{Total draft}}$

(3) Total draft table

NO. OF TEETH (T.D.C)	TOTAL DRAFT	NO. OF TEETH (T.D.C)	TOTAL DRAFT
22	15.85	48	7.26
23	15.12	49	7.11
24	14.53	50	6.97
25	13.94	51	6.84
26	13.41	52	6.70
26	13.41	53	6.58
27	12.91	54	6.46
28	12.45	55	6.34
29	12.02	56	6.23
30	11.62	57	6.12
31	11.25	58	6.01
32	10.89	59	5.91
33	10.56	60	5.81
34	10.25	61	5.71
35	9.96	62	5.62
36	9.68	63	5.53
37	9.42	64	5.45
38	9.17	65	5.36
39	8.94	66	5.28
40	8.72	67	5.20
41	8.50	68	5.13
42	8.30	69	5.05
43	8.11	70	4.98
44	7.92	71	4.91
45	7.74	72	4.84
46	7.58	73	4.78
47	7.42	74	4.71
		75	4.65

[4] Choosing the Back Draft Change Wheel (BDC)

(1) Back draft gearing diagram



(2) Calculation formula

$$\text{Back draft constant} = \frac{(28.5 + 1.4 \times 2 \times 0.8) \times 60 \times 33}{28.5 \times 26} = 82.14$$

Thickness of bottom apron = 1.4 mm

$$\text{No. of teeth on back draft change wheel} = \frac{82.14}{\text{Back draft}}$$

(3) Back draft table

1) When the change gear is fixed with a bolt

NO. OF TEETH (B.D.C)	BACK DRAFT	NO. OF TEETH (B.D.C)	BACK DRAFT
50	1.64	61	1.35
51	1.61	62	1.32
52	1.58	63	1.30
53	1.55	64	1.28
54	1.52	65	1.26
55	1.49	66	1.24
56	1.47	67	1.23
57	1.44	68	1.21
58	1.42	69	1.19
59	1.39	70	1.17
60	1.37		

[5] Choosing the Number of Roving Layers

The number of roving layers per 25.4 mm of bobbin lift can be calculated according to the following formula:

Number of roving layers “C” = $8.365 \times N^{0.6617}$

$N = 250/W$

where, N: Hank roving
W: Roving weight (g) per 30 yards

W	N	C	W	N	C	W	N	C	W	N	C
40	6.250	28.11	170	1.471	10.79	300	0.833	7.41	460	0.544	5.59
45	5.556	26.00	175	1.429	10.59	305	0.820	7.33	470	0.532	5.51
50	5.000	24.26	180	1.389	10.40	310	0.806	7.26	480	0.521	5.43
55	4.545	22.78	185	1.351	10.21	315	0.794	7.18	490	0.510	5.36
60	4.167	21.51	190	1.316	10.03	320	0.781	7.10	500	0.500	5.29
65	3.846	20.40	195	1.282	9.86	325	0.769	7.03	510	0.490	5.22
70	3.571	19.42	200	1.250	9.70	330	0.758	6.96	520	0.481	5.15
75	3.333	18.54	205	1.220	9.54	335	0.746	6.89	530	0.472	5.09
80	3.125	17.78	210	1.190	9.39	340	0.735	6.83	540	0.463	5.03
85	2.941	17.08	215	1.163	9.24	345	0.725	6.76	550	0.455	4.97
90	2.778	16.45	220	1.136	9.10	350	0.714	6.70	560	0.446	4.91
95	2.632	15.87	225	1.111	8.97	355	0.704	6.64	570	0.439	4.85
100	2.500	15.34	230	1.087	8.84	360	0.694	6.57	580	0.431	4.79
105	2.381	14.84	235	1.064	8.71	365	0.685	6.51	590	0.424	4.74
110	2.273	14.40	240	1.042	8.59	370	0.676	6.45	600	0.417	4.69
115	2.174	13.98	245	1.020	8.48	375	0.667	6.40	610	0.410	4.64
120	2.083	13.59	250	1.000	8.37	380	0.658	6.34	620	0.403	4.59
125	2.000	13.23	255	0.980	8.26	385	0.649	6.29	630	0.397	4.54
130	1.923	12.89	260	0.962	8.15	390	0.641	6.23	640	0.391	4.49
135	1.852	12.58	265	0.943	8.05	395	0.633	6.18	650	0.385	4.44
140	1.786	12.28	270	0.926	7.95	400	0.625	6.13	660	0.379	4.40
145	1.724	11.99	275	0.909	7.85	410	0.610	6.03	670	0.373	4.35
150	1.667	11.73	280	0.893	7.76	420	0.595	5.93	680	0.368	4.31
155	1.613	11.48	285	0.877	7.67	430	0.581	5.84	690	0.362	4.27
160	1.563	11.24	290	0.862	7.58	440	0.568	5.75	700	0.357	4.23
165	1.515	11.01	295	0.847	7.50	450	0.556	5.67			

(From the “BOGDAN TEXTILE RESEARCH JOUR. Sept. 1949”)

1.1.2 FL Conditions and Parameters to be Modified from the Operation Panel

The initial values of the FL conditions have been set up when the FL leaves TOYOTA. To obtain the optimum operating conditions, however, it is necessary to modify those parameters before the start of actual operation.

Modifying those parameters from the operation panel located at the GE of the FL allows the microprocessor to automatically set the optimum winding tension, speed change patterns and other conditions.

Machine Conditions

The machine conditions to be modified are classified into the following four groups:

(1) Basic roving conditions (including the fiber type, roving weight, flyer speed, number of presser windings, full-bobbin length, and number of twists)

(2) Bobbin shape

(3) Rail stop position

(4) On-halt sequence

*For information about each of the setting values, please refer to Section 5 of the text for the operation panel.

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Installation

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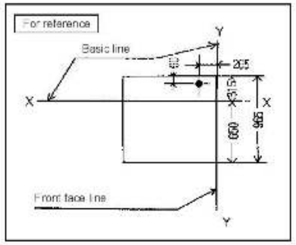
2.1 Installation

2.1.1 Preparation for Installation

⚠ CAUTION

During the following jobs, observe the precautions given in Section S.1, Subsection S.1.1, "Rules for Installation Work, [1] Before installation and [2] During installation."

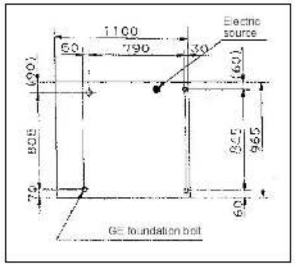
[1] Marking the Basic Lines for Installation


For reference
Y
Basic line
60
205
X
315
X
650
965
Front face line
Y

(1) Mark the X-X basic line for the overall frame length.

(2) Mark the Y-Y basic line up to the rear end of the creel pillar.

NOTE: As the X-X basic line affects the straightness of the frame, mark the line in one step. (The error shall be within 0.5 mm.)

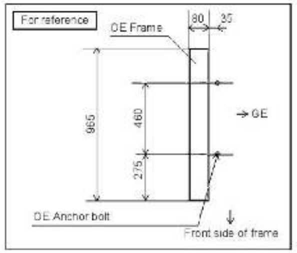

1100
Electric source
50
790
30
(90)
(60)
805
845
965
70
60
GE foundation bolt

NOTE: Confirm the positions of the power supply outlet hole and the pit.

IMPORTANT

Illustrated here are the anchor bolt positions for reference. Since the actual anchor bolt positions depend on the model and specification, drill the holes according to the drawing submitted from TOYOTA to each customer.

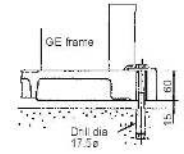
[2]   Drilling the Foundation Bolt Holes


For reference
OE Frame
80
35
965
460
275
→ GE
OE Anchor bolt
Front side of frame

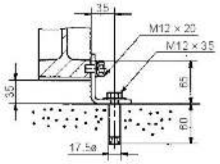
MPORTANT

Illustrated here are the anchor bolt positions for reference. Since the actual anchor bolt positions depend on the model and specification, drill the holes according to the drawing submitted from TOYOTA to each customer.

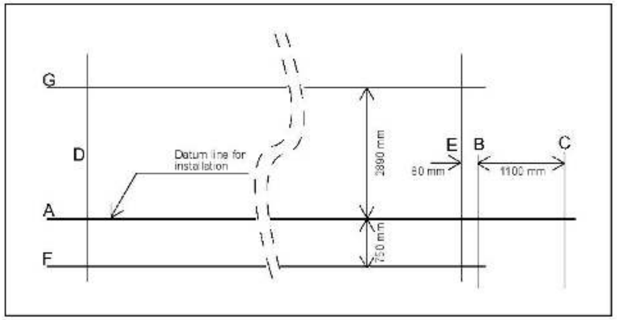
(1) Gear End Head Portion


GE frame
60
15
Drill dia
17.5ø

(2) Out End Frame Portion


35
M12 × 20
M12 × 35
35
65
60
17.5ø

[3]   Drilling and Chipping the Foot Step Embedding Holes


G
D
A
F
Datum line for installation
2890 mm
750 mm
E
B
C
80 mm
1100 mm

2.1.2 Unpacking and Washing

[1] Identification Marks

The three following types of identification marks are put at the time of FL assembly in Toyota

(1) Serial number: Pinched on the nameplate on the backside door.

(2) Scribed mark: Scribed with a scriber to indicate the part mounting position. (Example: Spring piece)

[2] Washing Method

(1) Do not remove bolts and installed parts as far as possible. If any is removed for an inevitable reason, install it immediately after washing.

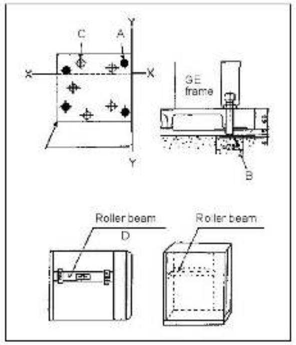
(2) Anticorrosive oil shall be washed with washing oil or wiped off with cloth wetted with washing oil.

(3) Parts to be in direct contact with material fibers shall be made perfectly free from oil by using French chalk. Special attention should be paid when removing oil from the bottom roller as its performance will be greatly degraded if the surface is damaged. This job should be performed according to the frame installation progress to prevent rusting. It is also recommended to clean the bottom roller immediately before installation.

The inside of the flyer roving pipe should be cleaned in the same way as the bottom roller.

(4) Each bearing especially requiring washing shall be washed twice (rough and finish) in clean white kerosene or spindle exclusively prepared for bearings, and be filled with specified amount of grease immediately. Sealed bearings, however, shall only be wiped with clean cloth and shall not be washed in the sealed state.

2.1.3 Leveling the Gear End Head



⚠ **CAUTION**

The following jobs should always be handled by at least three workers since those jobs involve handling heavy objects.

(1) Align the gear end head with X-X and Y-Y installation basic lines.

NOTE: Place adjust bolt base **B** (F0109-11010-00) under the adjust bolts.

(2) Carry out leveling at four adjust bolts **A**.

NOTE: Do not use adjust bolts **C** at five places (**O** marks).

(3) Check the leveling at the following points:

1) Three places **D** on roller beam

2.1.4 Temporarily Leveling the Spring Pieces

⚠ CAUTION

The following jobs should always be handled by at least three workers since those jobs involve handling heavy objects.

[1] Preparation

(1) Lay the spring pieces sequentially from the GE on the floor.

(2) Lay the front bottom stays sequentially from the GE on the floor.

(3) Distribute three spring piece bottom steps **E** for each spring piece.

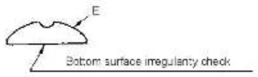
NOTE: Check the bottom face of each spring piece bottom step **E** for no surface irregularity.

(4) Prepare special tools for installation.

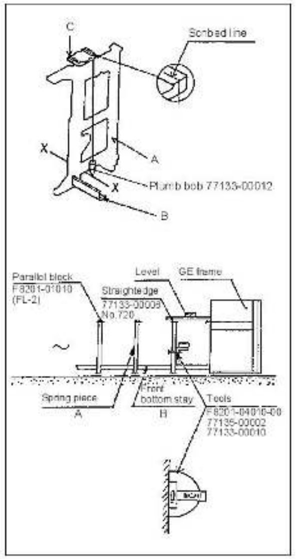
Special tools for installation

No.	Name	Tool No.	Q'ty
1	Straightedge (1800 mm)	77133-00006 (No. 720)	1
2	Level	77133-00007	3
3	Level base (for intermediate position)	F8201-04010-00 (FL-3)	3
4	Vice	77135-00002 (FS-4)	4
5	Parallel block	F8201-01010-00 (FL-2)	2
6	Plumb bob	77133-00012	2
7	Leveling string	77133-00018	1

(Old tool numbers are enclosed in parentheses.)



Step for spring piece


C
Scribed line
X
A
X
Plumb bob 77133-00012
B
Parallel block
F8201-01010
(FL-2)
Level
GE frame
Straightedge
77133-00008
No.720
~
Spring piece
A
Front
bottom stay
B
Tools
F8201-04010-00
77135-00002
77133-00010

[2] Temporary Leveling

(1) Raise spring piece **A** and install front bottom stay **B**.

Bolt used:M12 × 30 ℓ
Washer:ø12 mm

NOTE:

- Fix the front angle into close contact with the spring piece.
- The front angle clamping bolt should be tightened manually.

(2) Move the spring piece so that the plumb bob suspended from the scribed line on the spring piece is aligned with basic line (X-X) for installation.

NOTE: Move the spring piece by means of the spring piece bottom step.

(3) Adjust leveling of the spring pieces sequentially from No. 1 (GE).

NOTE: The level on the straightedge and level base must exactly indicate the center of scale. The levelness of the spring piece level base in the front to rear direction should be about 1/4 scale on the front high side.

NOTE: If paint adheres on the upper face of the spring piece **C**, remove it with a file or sandpaper.

(4) Repeat steps (1) to (3) for temporary leveling up to the final spring piece.

*Keep the OE laid down. "Install it after final leveling."

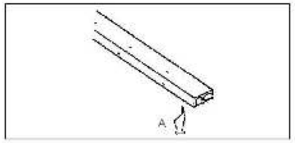
2.1.5 Installing the Roller Beams

⚠ CAUTION

The following jobs should always be handled by at least four workers since those jobs involve handling heavy objects.

Always wear a helmet whenever there is the possibility of injuring heads due to fall of something during horizontal adjustment or other jobs to be done near the floor.

[1] Preparation

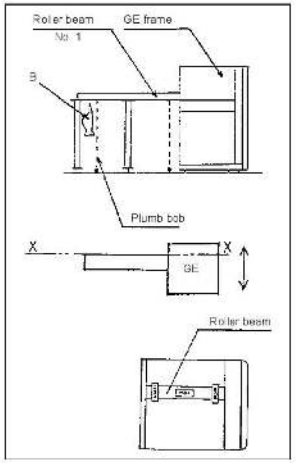


(1) Lay roller beams sequentially from the GE on the floor.

(2) Check that the bottom face of the roller beam mounting seat **A** is free from any paint adhesion or dent.

NOTE: If any dent is found, correct with a file or sandpaper.

[2] No. 1 Roller Beam Installation and Alignment in the GE Longitudinal Direction



(1) Install No.1 roller beam, and fix it after aligning its side face with the upper face of the roller beam on the GE head side.

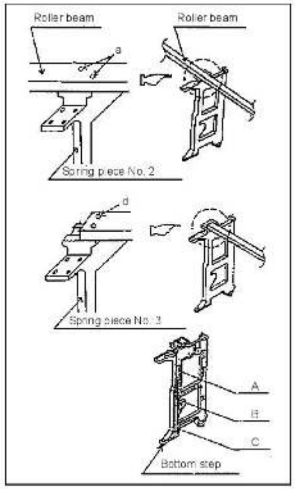
(2) When the roller beam is placed, raise the **B** portion a few times with a hand so that the roller beam is placed naturally on the spring piece.

NOTE: Do not connect the roller beam and spring piece with a bolt.

(3) Suspend a plumb bob from the rear end of the roller beam, and adjust it correctly to be aligned with the basic line (X-X) for installation.

NOTE: If not aligned, make adjustment by moving the GE head with a crowbar.

(4) Check leveling of the GE head again. See (3)



[3] Installing Roller Beams

(1) Temporarily align the front side faces of The roller beam with No. 1 and No. 2 spring pieces and eliminate the clearance at the mounting portions of front bottom stays No. 1 and No. 2 Then, fasten the bottom stays from the GE.

(2) Use a copper hammer and check the leveling in the horizontal direction of the level base installed on the slide portion of the spring piece. After making the roller beam ac spring piece flush on the front side, fasten the roller beam to the spring piece.

Leveling precision:

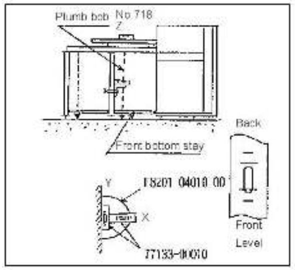
Longitudinal direction:0.05/150
Frame width direction:0.03/150

NOTE:

- Do not tap the front side of the roller beam and portions **A**, **B** and **C** of the spring piece with the hammer.
- Move the bottom step for correcting torsion of the spring piece.

2.1.6 Centering the Roller Beams

[1] Adjusting Leveling of the Roller Beams

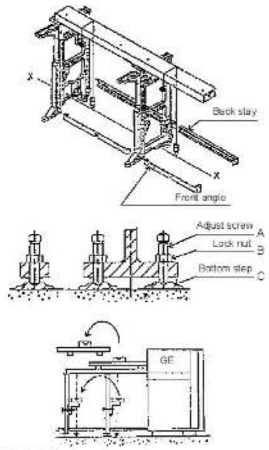


(1) For leveling in the longitudinal direction of the roller beam, place two parallel blocks and place a straightedge and a level on them.

(2) Set the level base (F8201-04010-00) onto the No. 2 spring piece, then put the level on the level base.

(3) While observing the level, turn the piece adjusting bolt for leveling **Z** in the roller beam longitudinal direction and leveling **X** and **Y** of the spring piece at the same time.

NOTE: Leveling in the front to rear direction of the slide position should be about 1/4 scale higher on the front side. (For flyer rail installation.)



NOTE

See that the plumb bob is aligned with the basic line.

(4) Move the spring piece No. 2 back and forth until the plumb bob is aligned with the basic line.

NOTE:

- If it cannot be moved, move the next spring piece at the same time.
- When moving a spring piece, always move it by means of the spring piece bottom step.

(5) After leveling adjustment, tighten the lock nut **B** for the adjusting bolt.

NOTE: Tap bottom step **C** with a spanner to see that spring piece adjusting bolt **A** is not floating.

(6) Fully tighten the front angle clamp bolt.

(7) Back stay installation

> Use hexagon head bolt M12 × 20 ℓ without any washer.

NOTE: When the blower motor is provided, use a special stay (with hole) at the blower motor mounting portion (4th intermediate portion).

[2] Adjusting Spring Piece Leveling

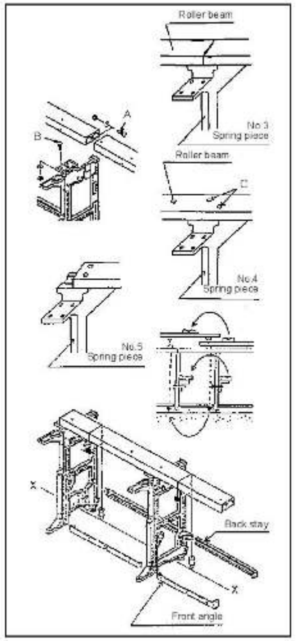
(1) Move the parallel blocks, straightedge and level base to above the No. 3 spring piece.

(2) Repeat steps (3) to (7) above.

NOTE: Rough installation of No. 2 and No. 3 spring pieces (at the first and second intermediate portions) shall be done correctly as it is important.

* It is used as the datum for next installation.

[3] Installation and Leveling Adjustment of No. 2 and Later Roller Beams



(1) Place No. 2 roller beam on the spring piece. After side face alignment with No. 1 roller beam, tighten mounting bolts first in the longitudinal direction **A** and in the vertical direction **B**.

NOTE: No. 2 roller beam has six M8 holes on top. Install it with the holes facing the GE side.

(2) Suspend a Plumb bob from the rear edge of the joint between No. 1 and No. 2 roller beams, for alignment with the frame installation basic line.

(3) Check deviation between the No. 1 and No. 2 roller beam joint and the front side of No. 2 spring piece as well as leveling of the spring piece slide portion.

(4) Temporarily align No. 2 roller beam with the front side of the No. 3 and No. 4 spring pieces, and tighten the front bottom stay mounting bolts sequentially from the GE.

(5) After checking leveling of the spring piece in the longitudinal direction and alignment of the spring piece and roller beam front side, tighten bolt **C**.

(6) Install the spring piece on the roller beam in the same way as in [3] (2).

(7) Then install No. 5 spring piece on the roller beam in the same way as above.

(8) Adjust leveling of the roller beam and spring pieces No. 3 and No. 4.

(9) The remaining roller beams and spring pieces shall be installed and leveled in the same way as above sequentially to the out end.

2.1.7 Installing and Adjusting Leveling of the OE Frame

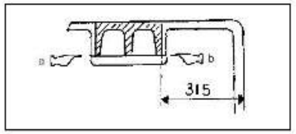
⚠ CAUTION

The following jobs should always be handled by at least four workers since those jobs involve handling heavy objects.

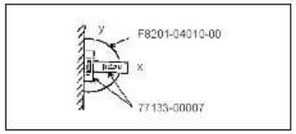
(1) Align the OE working datum plane and the rear side face of the roller beam.

(2) Bring the bottom side of the roller beam into close contact with the mounting seat on the OE frame.

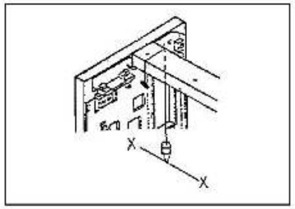
NOTE: Establish close contact at both **a** and **b** in the illustration at left.

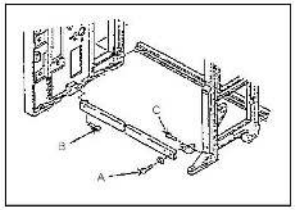


(3) Fix the level base on the slide portion and adjust leveling in the same way as for the spring piece.



(4) Move the OE bottom step to align the plumb bob with datum line X-X.





(5) Install the front angle after leveling adjustment.

METHOD:

1)Loosen bolt **A** lightly.

2)Tighten bolts **B** and **C**.

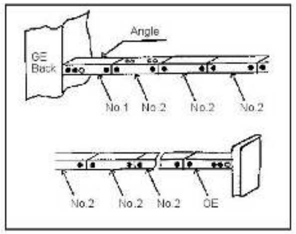
3)Finally tighten bolt **A**.

(6) Recheck leveling of the roller beams and spring pieces.

- Check leveling of each roller beam and spring piece from the GE to the OE.
- Make adjustment if correction is needed.

2.1.8 Installing the Angles for Feed Parts

[1] Preparation



Lay the angles sequentially from the GE on the floor.

■ Angle types

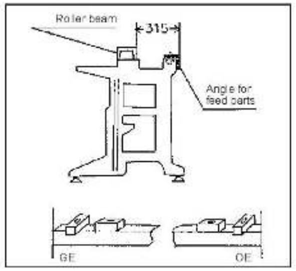
In case of 120 spindles: 3 types (when BS is provided)

(1) No.1 For GE

(2) No.2 For middle

(3) OE For OE

[2] Installation

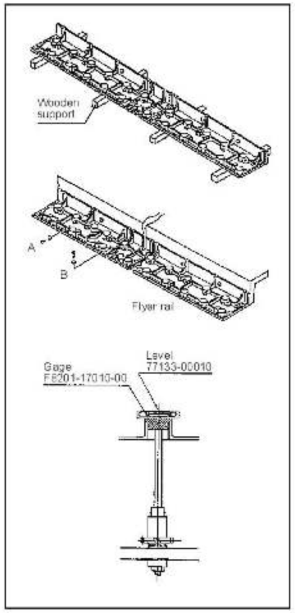


(1) Install at 315 mm from the roller beam.

Bolts to be used
Round-head bolt,M10 × 40 ℓ
Hex-head bolt,M12 × 30 ℓ
(at each of the GE and OE)

METHOD: Prepare and use a wooden gage.

(2) Check leveling in the longitudinal direction and in the front to rear direction at the top of the angle on the GE and OE.



2.1.9 Installing the Flyer Rails

[1] Preparation

(1) Lay flyer rails sequentially from the GE side on the floor.

NOTE: Rails are in three types for the GE, middle portion and OE which are different in length.

(2) Clean with washing oil and cloth.

[2] Installation

⚠ CAUTION

This job shall always be performed by three or more persons.

(1) Temporarily install flyer rails sequentially from the GE. Manually tighten the bolts lightly.

Bolts to be used: M12 × 40 ℓ

(2) After installing the boboin wheel, position the flyer rail in the longitudinal direction by means of the bobbin wheel centering gage.

(3) Tighten bolt **A** first and bolt **B** then.

(4) After positioning the flyer rails, fill up gaps between flyer rails with a sealing agent.

2.1.10 Installing the Lifter Shafts

⚠ CAUTION

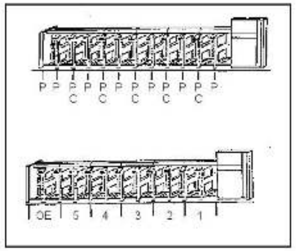
The following jobs should always be handled by at least two workers since those jobs involve handling heavy and long (2.6 m) objects.

[1] Preparation

(1) Place one lifter rack pinion **P** on the floor on the GE side of each spring piece.

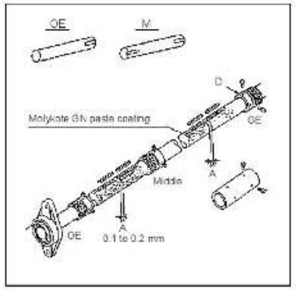
(2) Place one coupling **C** on the floor on the OE side of each roller beam joint.

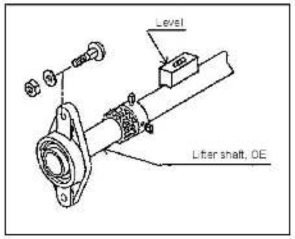
(3) Lay lifter shafts sequentially in the mounting order from the GE. (See the shaft layout drawing.)



Lifter shaft layout (Unit: mm)

7	6	5	4	3	2	1	Sequence	Specification
2555	→	→	→	→	→	2600	140 spindles	520-mm stuff
—	2555	→	→	→	→	2600	120 spindles	
—	—	2555	→	3120	→	2600	108 spindles	
—	—	2555	2080	→	→	2600	96 spindles	
—	2595	→	→	→	→	2640	144 spindles	440-mm stuff
—	1275	→	→	→	→	2640	132 spindles	
—	—	2595	→	→	→	2640	120 spindles	
—	—	1275	→	→	→	2640	108 spindles	
—	—	—	2505	→	→	2640	96 spindles	





[2] Installation

(1) Insert each shaft sequentially into the unit bearings installed on spring pieces from the OE.

METHOD: AT the time of insertion, fit the pinion to the shaft and correct the unit bearing inclination.

NOTE: Do not loosen or remove the unit bearing from the spring piece.

(2) Install the lifter pinion **P** with attention paid to the boss direction as illustrated at left.

(3) Fit coupling **C** to the shaft by matching the key way and the set screw direction.

(4) Adjust clearance **A** at the shaft joint to 0.1 to 0.2 mm by using a thickness gage, and fix the shaft by tightening the unit bearing set screw.

(5) Coat Molykote GN Paste and fit a coupling at each joint.

(6) Connect each shaft by the coupling and key.

(7) Install the unit bearing on the OE.

NOTE: Install the unit bearing, with its grease nipple on the upper side.

(8) Place a level on the lifter shaft for OE and adjust leveling in the longitudinal direction.

(9) Fully tighten the unit bearing set bolt.

2.1.11 Installing the Bobbin Rails

[1] Preparation

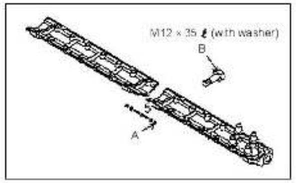
⚠ CAUTION

> The following jobs should always be handled by at least two workers since those jobs involve transferring heavy objects.

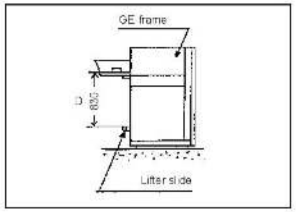
(1) Lay bobbin rails sequentially from the GE on the floor before the frame.

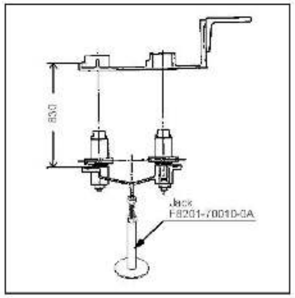
(2) Remove nut **A** from one side of the rail joint bolt and place it on the bottom of the bobbin rail.

(3) Place two each of lifter slide mounting bolts **B** and washers at the bobbin rail slide mounting portion.

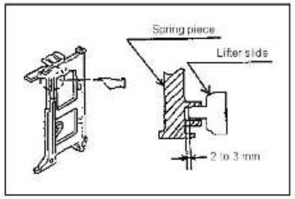


(4) Adjust the GE bobbin rail slide height (**D** in the figure at left) to 830 mm.




830
Jack
F8201-70010-0A

(5) Place a bobbin rail jack at each piece portion.


Spring piece
Lifter side
2 to 3 mm

(6) Distribute lifter slides complete from the GE.

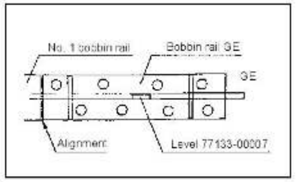
(7) Coat Molykote grease on both sides of the lifter slide. (The same applies to the OE.)

[2] Bobbin Rail Installation

(1) Install bobbin rails from the GE.

⚠ CAUTION

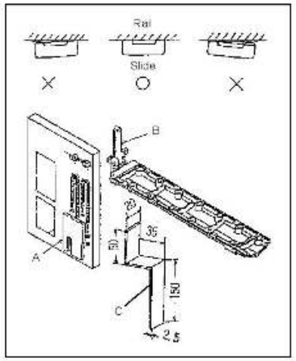
This job shall be performed by three or more persons. Insert the connecting bolt, check fitting of the rail rib in the jack groove, and temporarily tighten the joint connecting bolt before releasing the rail.



(2) 1)Adjust leveling by using the parallel block and straightedge.

2)Temporarily fasten the lifter rack on the bobbin rail.

3)After aligning the bobbin rail GE with the top and front faces on the GE, tighten the connecting bolt fully.
(Use a 22 × 24 wrench.)



(3) Install the lifter slide complete on the bobbin rail.

Bolt to be used: M12 × 35 ℓ (with washer)

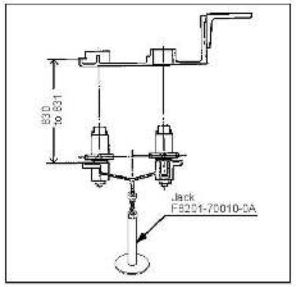
NOTE:

- Provide a 2.5 mm clearance between the piece and lifter slide. (Manufacture and use gage **C** illustrated at left.)
- Bring the slide jaw into close contact with the rail.

(4) Sequentially install in the same way up to the OE.

(5) Install OE balance weight **A** on OE lifter slide **B**.

[3] Adjusting Bobbin Rail Leveling

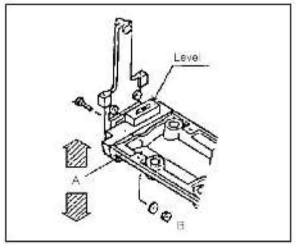


(1) Check that the bobbin rail height is 830 mm at each spring piece.

NOTE: The installed height error shall be within 1 mm (in the overall frame length).

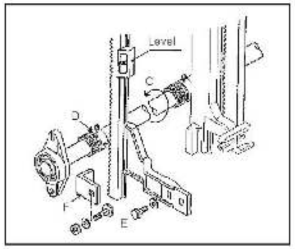
(2) Adjusting OE bobbin rail leveling in front to rear direction.

NOTE: See that the OE balance weight is installed.



1) Place the level in the illustrated position.
2) Loosen the lifter slide mounting bolts **B** a little. (2 places)
3) Manually move the **A** portion for leveling adjustment.
4) Tighten bolts **B** after the adjustment.

[4] Lifter Pinion Meshing



(1) After confirming meshing between the rack and pinion, raise the bobbin rail. Turn the pinion in the direction of arrow **C** and fix it.

(2) When the OE pinion meshing is defective, loosen two OE lifter set bolts **E** and move the rack for correct meshing.

NOTE: Confirm perpendicularity by bringing the level into contact with the rack.

(3) Bring stay **F** into light contact with the rack and install it. (0.50 mm)

2.1.12 Installing the Balance Spring Shafts

⚠ CAUTION

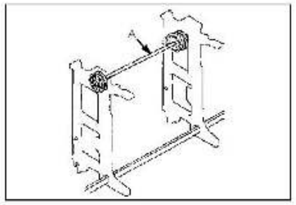
The following jobs should always be handled by at least two workers since those jobs involve handling heavy objects.

[1] Preparation

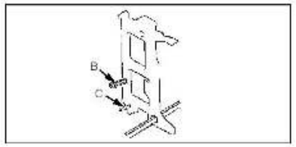
(1) Put a set of a balance spring, weight lever stud, balance spring stud near each of the spring pieces.

[2] Installation

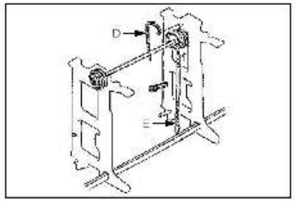
(1) Place a balance spring shaft **A** across spring pieces.



(2) Install weight lever stud **B** and balance spring stud **C** on the spring piece.



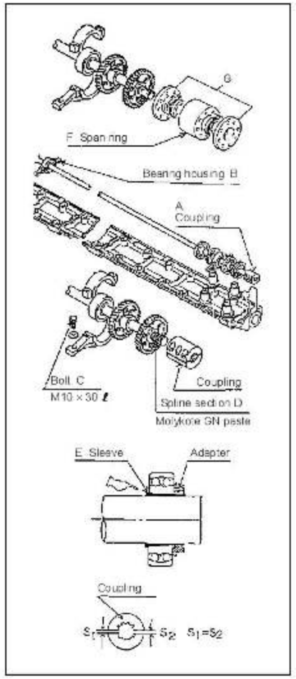
(3) Hook chains **D** and **E** onto the pulley mounted on the balance spring shaft.



2.1.13 Installing the Bobbin Shafts

⚠ CAUTION

The following jobs should always be handled by at least two workers since those jobs involve handling heavy objects.



[1] Preparation

(1) Lay bobbin shafts (on which the gears and other parts have been set) on the floor in front of the FL sequentially from the GE.

NOTE: The bobbin shaft closest to the GE should be placed with the non-spline side facing towards the GE. Other bobbin shafts should be placed with coupling **A** facing towards the GE.

(2) Remove the coupling and coat Molykote GN paste on the spline portion **D**.
(Install the coupling after coating.)

NOTE:

- To the span rings, apply machine oil instead of Molykote.
- Components **G** are set on the bobbin shaft placed on the GE side.

[2] Installation

(1) Install the bobbin shaft on the bobbin rail sequentially from the GE, and tighten bolt **C** manually.

(2) Connect bobbin shafts by using the coupling.

1) The clearance between shafts shall be 0.1 to 0.2 mm. (Use a thickness gage for measurement.)

2) Coupling clearance S shall be equally distributed.

3) The screws on the Span ring should be tightened in a "diagonal" sequence.

(3) Tighten the bearing nut.

1) Manually push sleeve **E** in.

2) Tighten the adapter three to four turns with a removing jig and hammer.

NOTE: Overtightening will deform the inner race so as to cause abnormal noise or generate heat, resulting in an early damaged bobbin shaft.

3) Bend the toothed spring washer for locking.

4) Check to see that bolt **C** can be rotated easily. (Confirm no offset from the prepared hole.)

2.1.14 Installing the Balance Springs

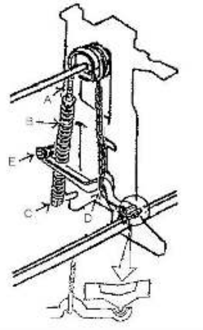
⚠ CAUTION

Always keep one jack on the GE unremoved.

[1] Preparation

(1) Distribute springs **B** on the rear side of the frame.

[2] Installation

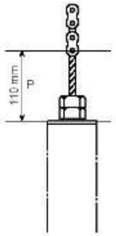


(1) Install chain screw **A** at each end of the shaft to spring **B**. (Screw it in by about 10 mm.)

(2) Set spring on the stud **C**.

(3) Hang the weight lever to **E**.

(4) Catch the weight lever by the weight lever stud **E**.



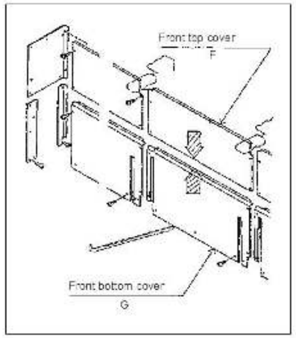
(5) After setting all balance springs and balance weight levers, adjust the spring load to the state **P** shown in the figure at left.

NOTE: Set the spring load to adjust the distance between the center of the chain pin and the spring upper face to 110 mm in two steps as follows:

- First tighten the chain screw by about a half for every spring.
- Then set to 110 mm as illustrated.

(6) Remove jacks except for the one on the GE.

2.1.15 Installing the Front Top & Bottom Covers


Front top cover
F
Front bottom cover
G

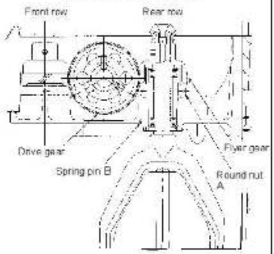
(1) Install the front top cover **F**.

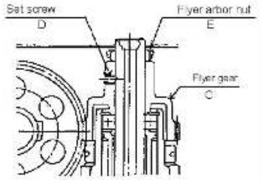
NOTE: Bring the cover into close contact with the bottom face of the flyer rail.

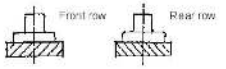
(2) Install the front bottom cover **G**.

NOTE: The top and bottom covers shall be in close contact with each other.

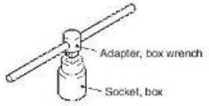
Flyer installation drawing


Front row
Rear row
Drive gear
Spring pin B
Flyer gear
Round nut
A


Set screw
D
Flyer arbor nut
E
Flyer gear
C


Front row
Rear row

Flyer arbor nut tightening tool


Adapter, box wrench
Socket, box

2.1.16 Installing the Flyers

[1] Preparation

(1) Place round nut **A** and special washer near each flyer rail mounting hole.

(2) Carry flyers in packed state to the front of the frame.

(3) See that the front top and bottom covers are kept installed.

(4) Apply Molykote grease (GN paste) to the flyer mounting holes.

[2] Installation

(1) Install the flyers in the rear row first.

1) Align the spring pin **B** on the bottom side of the flyer rail with the pin groove in the flyer housing. After fitting, tighten with round nut **A**.

NOTE: Manually tighten the round nut **A** until the housing comes into close contact with the rail.

2) Tighten the round nut with a placer and hammer.

(2) Install the flyer gear.

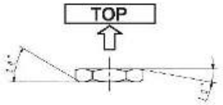
1) Fit the rear gear **C** to the flyer.

2) Tighten the set screw **D** after matching with the flyer bar set position.

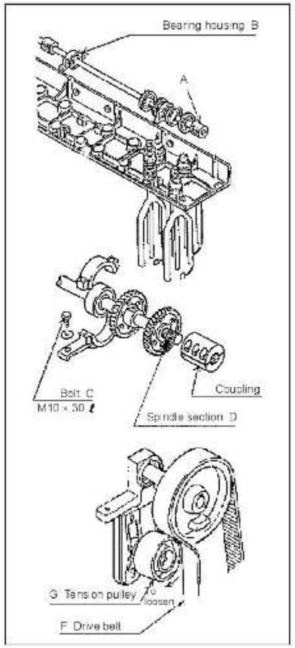
(3) Tighten the flyer arbor nut **E**.

NOTE:

- Use the flyer arbor nut tightening tool.
- Set the nut as shown below.



(4) After installing the flyers in the rear row, install the flyers in the front row in the same way.



2.1.17 Installing the Flyer Shafts

⚠ CAUTION

The following jobs should always be handled by at least three workers since those jobs involve handling heavy objects.

[1] Preparation

(1) Lay flyer shafts from the GE on the floor in front of the frame.

NOTE: The span ring shall be on the GE in the case of the Flyer shaft closest to the GE. Other flyer shafts shall be placed with coupling **A** on the GE.

(2) Remove the coupling and coat Molykote GN paste on the spline portion **D**.

NOTE: Coat machine oil in place of Molykote on the span ring.

NOTE: Install the coupling after coating.

(3) Place two each of mounting bolts **C** and washers near each mounting seat.

[2] Installation

⚠ CAUTION

Wear gloves for this job.

(1) Install the flyer shaft on the rail sequentially from the GE, and tighten bolt **C** manually.

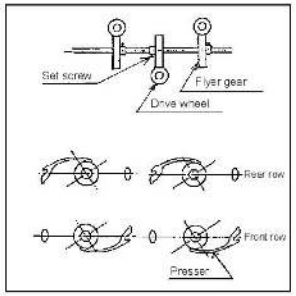
(2) Tighten the bearing nut in the same way as in [2] (3)

(3) Loosen the tension pulley **G** for drive belt **F**, and remove the belt from the pulley.

(4) Connect the shafts by means of the coupling in the same way as in [2] (2)

2.1.18 Positioning the Flyers

[1] Preparation



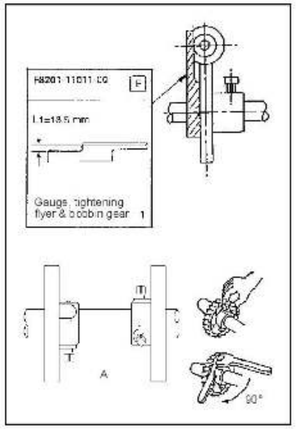
(1) Loosen all drive wheel set screws.

(2) Fix the flyer on the rear row in the position illustrated at left.

METHOD: Tie a 3 m long rectangular timber (or a separator supporting pipe if such a timber is not available) to the flyer with a string for fixation.

NOTE: To run the FL having the stuff of 440 mm without loading bobbins in the speed of 1450 rpm or more, shift the phase of the flyers in the front row from that in the rear row by 20° to 25° from the relative position. Otherwise, the presser mounting bolts in the front and rear rows will interfere with each other.

[2] Drive Wheel Positioning



(1) Use gage (F8201-11011-00) and determine the drive wheel position.

(2) The set screw shall be positioned symmetrically to obtain wheel rotation balance. See **A** in the illustration at left.

(3) Tighten set screws to a constant torque according to the steps below.

1) Hole the screw head with finger tips, and tighten the screw until the screw tip end comes into contact with the shaft.

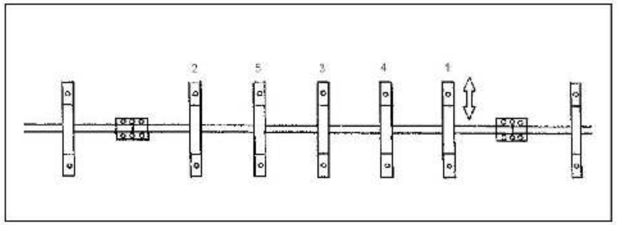
2) Set a wrench on the screw head and tighten 90° further. (Tightening torque: 11.8 N•m = 120 kgf•cm)

NOTE: The gear of the spline section has a brass locking chip under the setscrew.

[3] Positioning Bearing Housings

(1) With one shaft and two flyer rails as a set, position the bearing housings in the order of the numbers shown in the figure below.

(2) After the end of centering, manually recheck gear backlash for all housings.



2.1.19 Setting Up the Lubrication System

[1] Bobbin Gear Lubrication System

Carry out steps (1) to (3) below before bobbin rail installation.

(1) Install the junction **B** and pipe **C** on the bobbin rail.

See the lubrication system diagram for the piping.

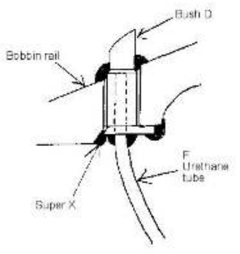
(2) Carry out piping between the junctions **B** and bushes **D** as illustrated below.

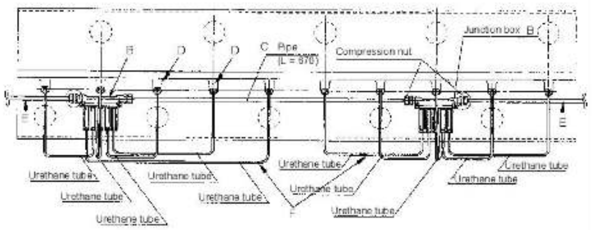
(3) Fully drive each of the urethane tubes **F** into each of the bushings **D**. (Drive-in depth: 14 mm)

(4) Fill in gaps between bushings and urethane tubes and between bushings and bobbin rail with Super X glue. (Be sure to apply Super X glue to the entire circumference of those bushings.)

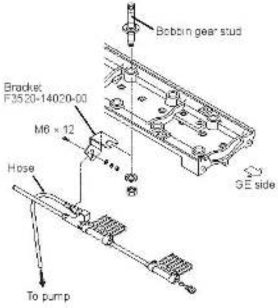
(5) Put bobbin drive gears on the bobbin rail.

(6) Link junctions **B** with pipe **E**.

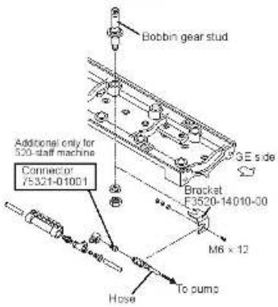

Bush D
Bobbin rail
F
Urethane
tube
Super X


B
D
D
C Pipe
(L = 670)
Compression nut
Junction box B
E
E
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
F

For 440 staffs


Bobbin gear stud
Bracket
F3520-14020-00
M6 × 12
Hose
GE side
To pump

For 520-staff


Bobbin gear stud
Additional only for
520-staff machine
Connector
75321-01001
GE side
Bracket
F3520-14010-00
M6 × 12
To pump
Hose

(7) Install the pump block **A** on the spring piece.

(8) Connect the pump and junction with hose **B**

(9) Installing the hose fixing bracket

1) Fix the bracket using the washer and nut for the bobbin gear stud.

2) Pass the bobbin lubricator hose through the bracket.

3) Install a hexagon socket head bolt (M6 × 12), washer, spring washer and nut on the bracket (in two places) to prevent the hose from coming off.

4) In case of a 520-staff machine, the hose direction is the reverse that in the 440-staff machine. Add a connector to adjust the hose fixing position.

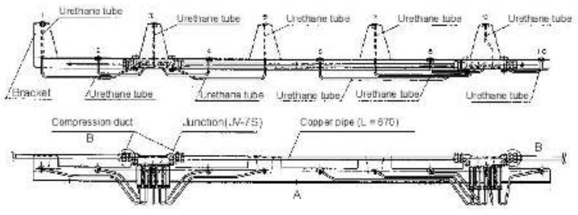
Please install other parts in the same way as in the 440-staff machine.

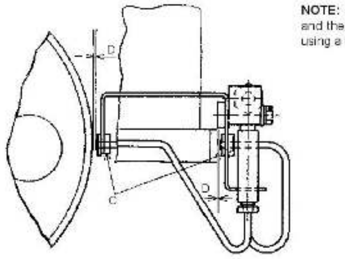
[2] Flyer Gear Lubrication System

See the lubrication system diagram for the piping.

(1) Install the flyer gear lubrication bracket installed with junction) **A** on the flyer rail.

(2) Connect junctions with pipes **B**.


Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Bracket
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Urethane tube
Compression duct
B
Junction(JV-7S)
Copper pipe (L = 670)
B
A

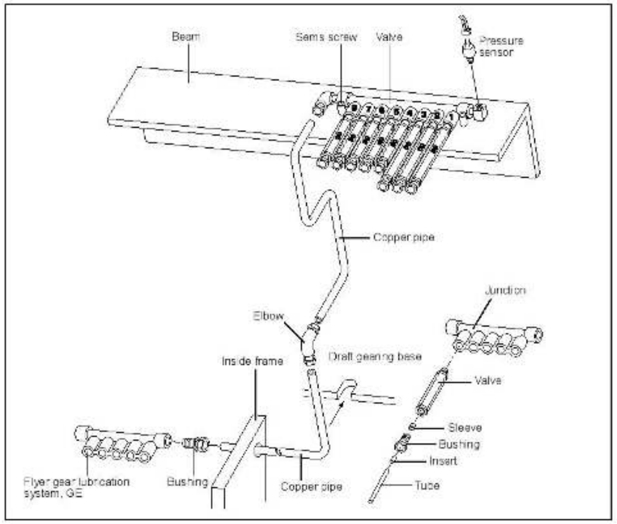


NOTE: Set clearance **D** between bushings **C** and the drive wheel to approx. 0.2-0.6 mm by using a thickness gage.

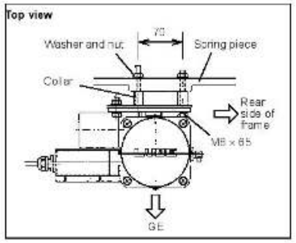
[3] Draft Gear Lubrication System

(1) Connect a pipe to the GE end of the flyer gear lubrication system.

(2) Connect the pipe to the elbow of the draft gearing lubrication system.

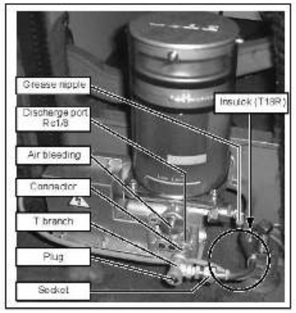

Beam
Sems screw
Valve
Pressure sensor
8
7
6
5
4
3
2
1
Copper pipe
Junction
Elbow
Draft gearing base
Inside frame
Valve
Sleeve
Bushing
Insert
Tube
Flyer gear lubrication system, GE
Bushing
Copper pipe

[4] Pump


Top view
70
Washer and nut
Spring piece
Collar
Rear side of frame
M8 × 65
GE

(1) Pump installation

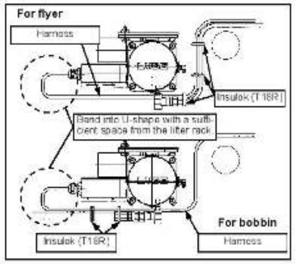
Fix the pump onto two 10.2-mm drilled holes using M8 bolts and nuts.


Grease nipple
Discharge port Rc1/8
Air bleeding
Connector
T branch
Plug
Socket
Insulok (T18R)

(2) Piping

Connect the parts and the copper pipe as shown in the photo. (The photo shows the flyer pump.)

Bend the copper pipe into U-shape to prevent interference with the balance spring, and connect it with the hose.


For flyer
Harness
Insulok (T18R)
Bend into U-shape with a sufficient space from the lifter rack
For bobbin
Insulok (T18R)
Harness

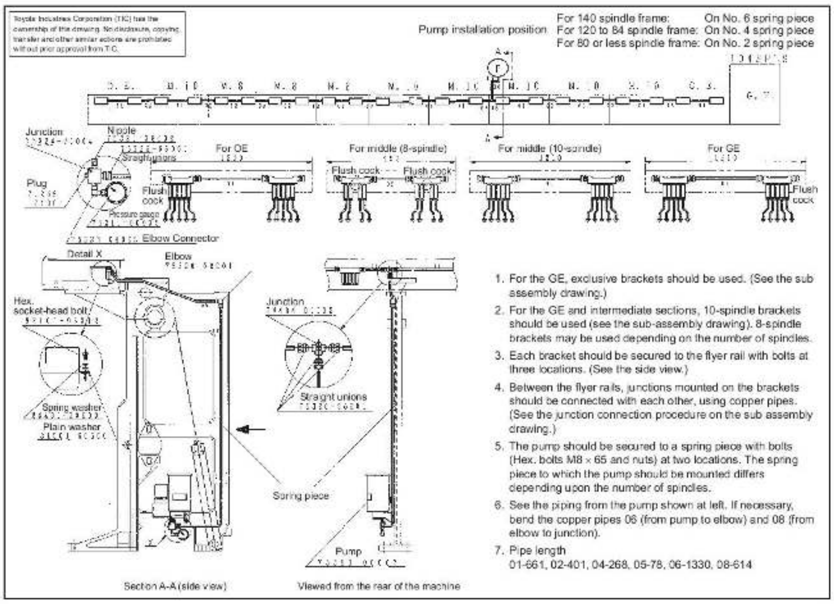
(3) Wiring

Fix the pump cable with Insulok as illustrated and pass it through the backstay.

Since the lifter rack is close to the electrical cable, be sure to provide sufficient space between the lifter rack and electrical cable when bending the cable into a "U" shape.

Do not bundle the bobbin pump pressure sensor cable (signal cable) with the pump cable (power cable).

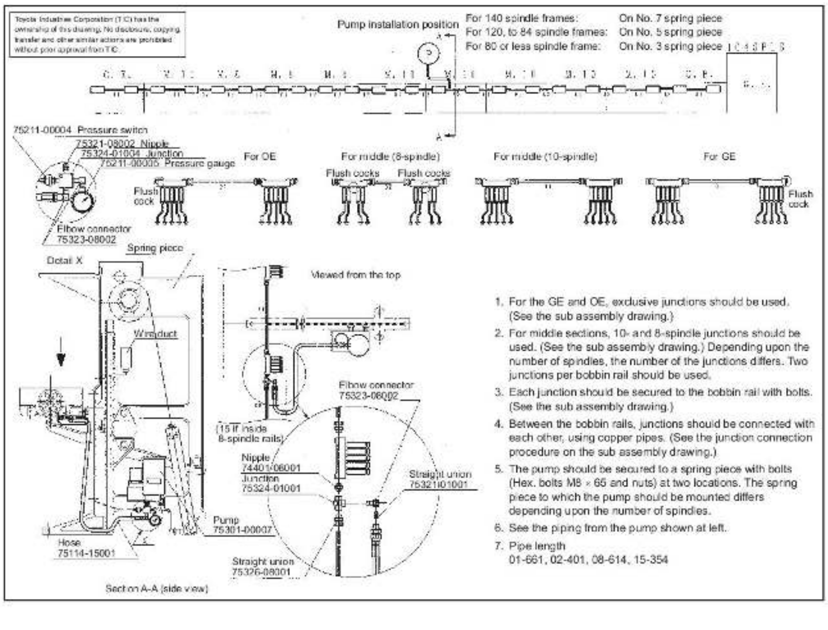
■ Flyer Gear Lubrication System Diagram 1/4 (For 520 mm stuff)


Pump installation position
For 140 spindle frame: On No. 6 spring piece
For 120 to 84 spindle frame: On No. 4 spring piece
For 80 or less spindle frame: On No. 2 spring piece
A
A
Junction
Nipple
Straight unions
Plug
Flush cock
Pressure gauge
Elbow Connector
For OE
For middle (8-spindle)
Flush cock
Flush cock
For middle (10-spindle)
For GE
Flush cock
Detail X
Elbow
Hex. socket-head bolt
Spring washer
Plain washer
Junction
Straight unions
Spring piece
Pump
Section A-A (side view)
Viewed from the rear of the machine

Toyota Industries Corporation (TIC) has the ownership of this drawing. No disclosure, copying, transfer and other similar actions are prohibited without prior approval from TIC.

1. For the GE, exclusive brackets should be used. (See the sub assembly drawing.)
2. For the GE and intermediate sections, 10-spindle brackets should be used (see the sub-assembly drawing). 8-spindle brackets may be used depending on the number of spindles.
3. Each bracket should be secured to the flyer rail with bolts at three locations. (See the side view.)
4. Between the flyer rails, junctions mounted on the brackets should be connected with each other, using copper pipes. (See the junction connection procedure on the sub assembly drawing.)
5. The pump should be secured to a spring piece with bolts (Hex. bolts M8 × 65 and nuts) at two locations. The spring piece to which the pump should be mounted differs depending upon the number of spindles.
6. See the piping from the pump shown at left. If necessary, bend the copper pipes 06 (from pump to elbow) and 08 (from elbow to junction).
7. Pipe length
   01-661, 02-401, 04-268, 05-78, 06-1330, 08-614

■ Bobbin Gear Lubrication System Diagram 2/4 (For 520 mm stuff)

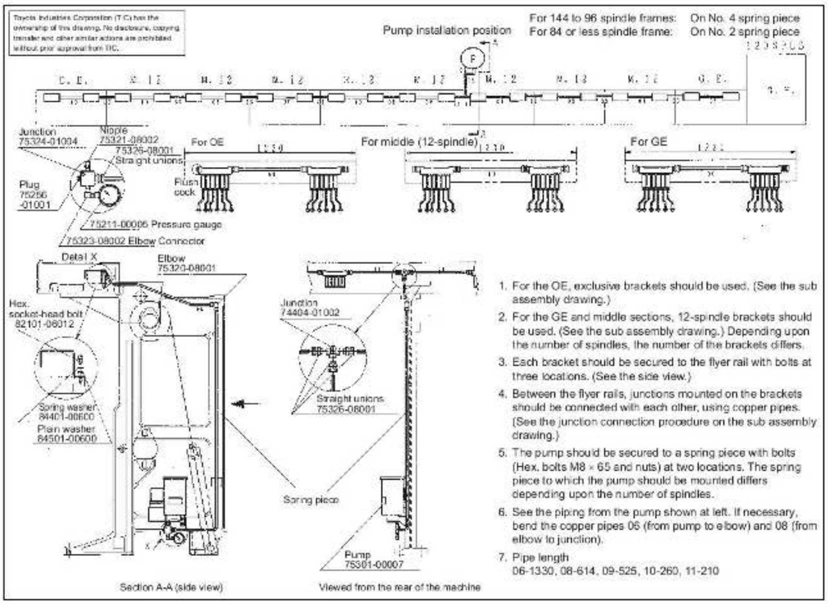

Pump installation position
For 140 spindle frames: On No. 7 spring piece
For 120, to 84 spindle frames: On No. 5 spring piece
For 80 or less spindle frame: On No. 3 spring piece
P
A
75211-00004 Pressure switch
75321-08002 Nipple
75324-01004 Junction
75211-00005 Pressure gauge
Flush cock
Elbow connector
75323-08002
For OE
For middle (8-spindle)
Flush cocks
Flush cocks
For middle (10-spindle)
For GE
Flush cock
Spring piece
Detail X
Wire duct
Viewed from the top
Elbow connector
75323-08002
(15 If inside 8-spindle rails)
Nipple
74401-08001
Junction
75324-01001
Straight union
75321-01001
Pump
75301-00007
Hose
75114-15001
Straight union
75326-08001
Section A-A (side view)

Toyota Industries Corporation (TIC) has the ownership of this drawing. No disclosure, copying, transfer and other similar actions are prohibited without prior approval from TIC.

1. For the GE and OE, exclusive junctions should be used. (See the sub assembly drawing.)
2. For middle sections, 10- and 8-spindle junctions should be used. (See the sub assembly drawing.) Depending upon the number of spindles, the number of the junctions differs. Two junctions per bobbin rail should be used.
3. Each junction should be secured to the bobbin rail with bolts. (See the sub assembly drawing.)
4. Between the bobbin rails, junctions should be connected with each other, using copper pipes. (See the junction connection procedure on the sub assembly drawing.)
5. The pump should be secured to a spring piece with bolts (Hex. bolts M8 × 65 and nuts) at two locations. The spring piece to which the pump should be mounted differs depending upon the number of spindles.
6. See the piping from the pump shown at left.
7. Pipe length
   01-661, 02-401, 08-614, 15-354

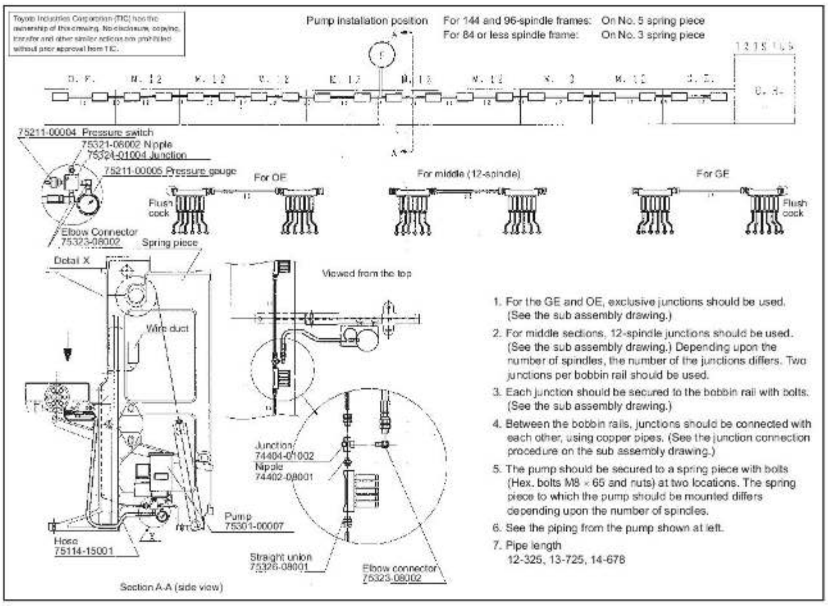
■ Flyer Gear Lubrication System Diagram 3/4 (For 440 mm stuff)

Toyota Industries Corporation (TIC) has the ownership of this drawing. No disclosure, copying, transfer and other similar actions are prohibited without prior approval from TIC.


Pump installation position
For 144 to 96 spindle frames: On No. 4 spring piece
For 84 or less spindle frame: On No. 2 spring piece
P
A
O. E.
M. 12
M. 12
M. 12
M. 12
M. 12
M. 12
M. 12
M. 12
G. E.
Junction
75324-01004
Nipple
75321-08002
75326-08001
Straight unions
Plug
75256
-01001
75211-00006 Pressure gauge
75323-08002 Elbow Connector
For OE
Flush cock
For middle (12-spindle)
For GE
Detail X
Elbow
75320-08001
Hex. socket-head bolt
82101-06012
Spring washer
84401-00600
Plain washer
84501-00600
X
Junction
74404-01002
Straight unions
75326-08001
Spring piece
Pump
75301-00007
Section A-A (side view)
Viewed from the rear of the machine

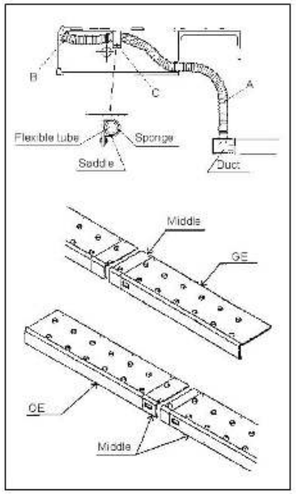
1. For the OE, exclusive brackets should be used. (See the sub assembly drawing.)
2. For the GE and middle sections, 12-spindle brackets should be used. (See the sub assembly drawing.) Depending upon the number of spindles, the number of the brackets differs.
3. Each bracket should be secured to the flyer rail with bolts at three locations. (See the side view.)
4. Between the flyer rails, junctions mounted on the brackets should be connected with each other, using copper pipes. (See the junction connection procedure on the sub assembly drawing.)
5. The pump should be secured to a spring piece with bolts (Hex. bolts M8 × 65 and nuts) at two locations. The spring piece to which the pump should be mounted differs depending upon the number of spindles.
6. See the piping from the pump shown at left. If necessary, bend the copper pipes 06 (from pump to elbow) and 08 (from elbow to junction).
7. Pipe length
   06-1330, 08-614, 09-525, 10-260, 11-210

■ Bobbin Gear Lubrication System Diagram 4/4 (For 440 mm stuff)


Toyota Industries Corporation (TIC) has the ownership of this drawing. No disclosure, copying, transfer and other similar actions are prohibited without prior approval from TIC.

Pump installation position
For 144 and 96-spindle frames: On No. 5 spring piece
For 84 or less spindle frame: On No. 3 spring piece
O. E.
M. 12
G. E.
75211-00004 Pressure switch
75321-08002 Nipple
75324-01004 Junction
75211-00005 Pressure gauge
Elbow Connector
75323-08002
Spring piece
Detail X
For OE
For middle (12-spindle)
For GE
Flush cock
Viewed from the top
Wire duct
Junction
74404-01002
Nipple
74402-08001
Pump
75301-00007
Hose
75114-15001
Straight union
75326-08001
Elbow connector
75323-08002
Section A-A (side view)
A

1. For the GE and OE, exclusive junctions should be used. (See the sub assembly drawing.)
2. For middle sections, 12-spindle junctions should be used. (See the sub assembly drawing.) Depending upon the number of spindles, the number of the junctions differs. Two junctions per bobbin rail should be used.
3. Each junction should be secured to the bobbin rail with bolts. (See the sub assembly drawing.)
4. Between the bobbin rails, junctions should be connected with each other, using copper pipes. (See the junction connection procedure on the sub assembly drawing.)
5. The pump should be secured to a spring piece with bolts (Hex. bolts M8 × 65 and nuts) at two locations. The spring piece to which the pump should be mounted differs depending upon the number of spindles.
6. See the piping from the pump shown at left.
7. Pipe length
   12-325, 13-725, 14-678



2.1.20 Installing the Flyer Rail Covers

[1] When the Flyer Rail Cover Cleaning Device is Optionally Provided

(1) Install flexible tube **A** on the cover using band **B** and mounting saddle **C**.

NOTE:

- Always adhere sponge on the inside of saddle **C**.
- Install the tube without letting it sag between band **B** and saddle **C**. Otherwise, the tube may be broken by contact with the flyer drive shaft.

(2) Install covers sequentially from the GE.

NOTE: Install each cover so as not to let the upper part of the flyer arbor come into contact with the cover.

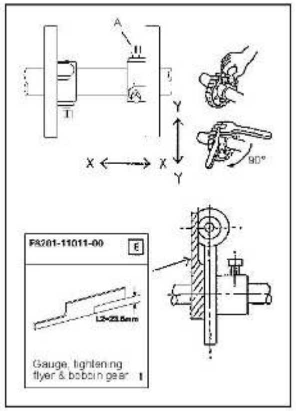
[2] When the Flyer Rail Cover Cleaning Device is not Provided

(1) Install the covers sequentially from the GE.

NOTE: Install each cover so as not to let the upper part of the flyer arbor come into contact with the flyer cover.

2.1.21 Centering the Bobbin Gears

[1] Positioning the Drive Gear


A
Y
X
X
Y
90°
F8201-11011-00
E
L2=23.5mm
Gauge, tightening flyer & bobbin gear

(1) Use gage (F8201-11011-00) for positioning the drive gear.

(2) The set screw **A** shall be positioned symmetrical to the one for the adjacent wheel to obtain the rotation balance of the wheel.

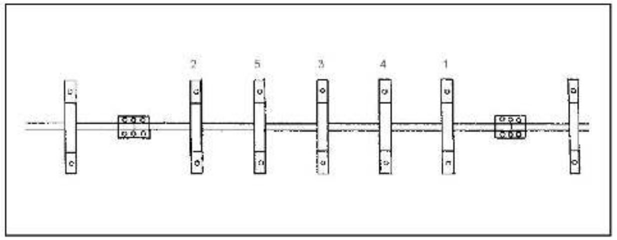
(3) The set screw tightening torque shall be unified.

The tightening method is the same as that described in [2] (3)

[2] Positioning the Bearing Housings

(1) With one shaft and two flyer rails as one set. Position the bearing housings in the order of the numbers in the figure below.

(2) After the end of centering, manually check gear backlash in all housings.



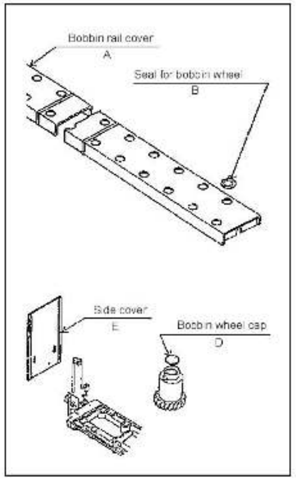
2.1.22 Installing the Bobbin Rail Covers

[1] Preparation

Coat specified grease on bobbin wheels and drive wheels.

NOTE: Coat wholly on wheels.

[2] Installation


Bobbin rail cover
A
Seal for bobbin wheel
B
Side cover
E
Bobbin wheel cap
D

(1) Install covers **A** sequentially from the OE.

NOTE:

- There shall be a clearance between the bobbin wheel and hole in the cover.
- The cover shall be retained by the rail spring pin.
- The cover shall be installed correctly in the front to rear direction.

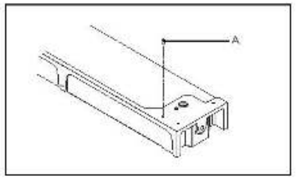
(2) Install the bobbin wheel cap **D**.

(3) Install the top cover for bobbin wheel **B**.

(4) Install the side cover **E** at the OE.

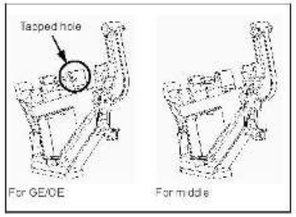
2.1.23 Installing the Bottom Rollers

[1] Roller Stand Installation and Centering



(1) Insert straight pin **A** into the roller beam roller stand mounting seat.

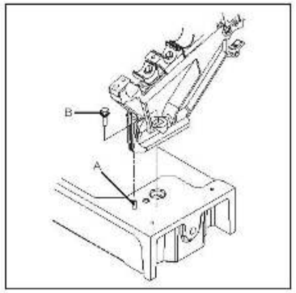
NOTE: Always insert the pin fully to the bottom of the hole with a hand. Never use a hammer.



(2) Distribute roller stands on the roller beam.

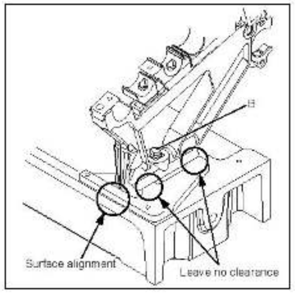
NOTE: Roller stands are in two types: for GE/OE and for middle.
The one for the GE/OE has a tapped hole on the back roller side.

NOTE: Carefully operate so as not to damage the painted surface of the roller beam.



(3) Fit each roller stand to pin **A**, and install it on the roller beam by tightening bolt **B**.

NOTE: Carefully align with the pin hole. Always tighten with a hand and never use a spanner or other tool.



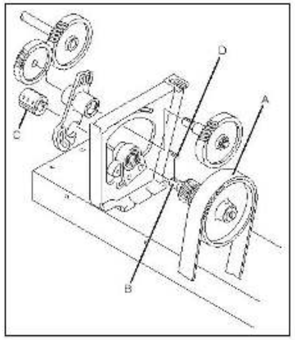
(4) Use the roller stand tool, and

1) Align the role stand and tool surfaces, and

2) Tighten bolt **B** after checking no clearance between the roller stand and tool surface.

NOTE: Use the plastic hammer supplied with the machine for adjustment.

[2] Connecting Bottom Rollers with Centering

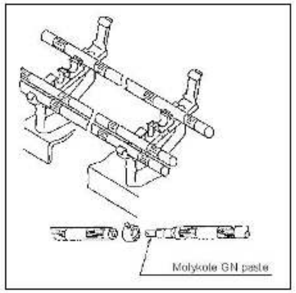


(1) Remove timing belt **A** for driving the bottom rollers and disconnect from the gearing.

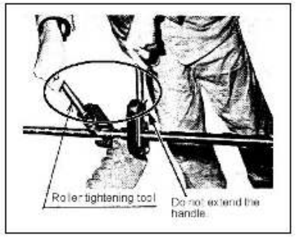
(2) Remove coupling **C** and parallel key **D** from front roller shaft **B**.

(3) Wipe anticorrosive oil from the bottom rollers and arrange the parts roller by roller.

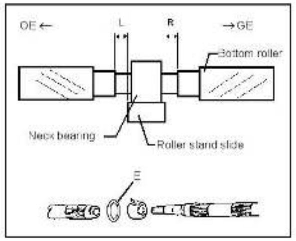
NOTE: If the period after installation until trial running is long, only wipe with cloth. (Since full removal of the anticorrosive oil may cause rusting.)
Clean the main body and threaded portion carefully with a toothbrush or the like before installation.


Molykote GN paste

(4) Sequentially place each front roller on the roller stand, apply Molykote on the male thread, and link them from the GE.


Roller tightening tool
Do not extend the handle.

NOTE: Do not extend the roller tightening tool handle with a steel pipe.

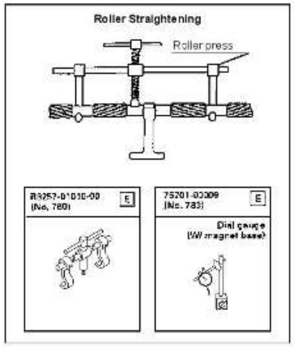

OE ←
L
R
→GE
Bottom roller
Neck bearing
Roller stand slide
E

(5) Adjust the roller length.
While fitting the bottom roller, measure dimensions **L** and **R** each time. If the allowable tolerance of 2 mm is exceeded, make adjustment by inserting provided shim(s) (0.3 mm in thickness each).

NOTE: Always insert shim(s) on the OE side.

(6) Link the second, third and back rollers similarly with necessary adjustment.

[3] Correcting Bottom Roller Runout on the Frame


Roller Straightening
Roller press
R8257-01030-00
(No. 780)
E
75201-00009
(No. 783)
E
Dial gauge
(W/ magnet base)

(1) While manually rotating the roller, check runout of the roller with a dial gage. Straighten the connected rollers by using the roller press tool.

Runout: 3/100 or less

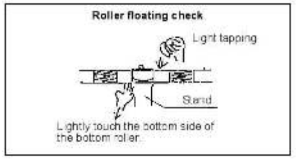
NOTE:

- The roller press shall be applied beside a bearing and never on the bearing.
- Never touch rollers with bare hands as they will get rusted. (Wear gloves.)
- Press the OE side of a bearing.

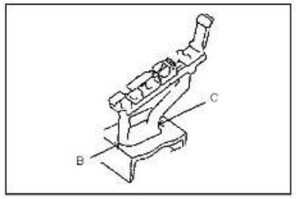
(2) Carefully check the runout of the portions connected on the frame.

(3) After correcting front rollers, correct the back rollers in the same way.

(4) Then, check each stand to see that the roller is not floating.


Roller floating check
Light tapping
Stand
Lightly touch the bottom side of the bottom roller.

METHOD: Tap the roller lightly with the right hand while touching the bottom of the roller with the index finger of the left hand for confirmation by feeling.



(5) If the front or back roller is floating, adjust it by inserting a shim under the front of the stand **B** or rear of the stand **C**, respectively.

NOTE: Fold aluminum foil into two or three plies as the shim. (Use paper if aluminum foil is not available.)

(6) Check roller floating as described above at all roller stands.

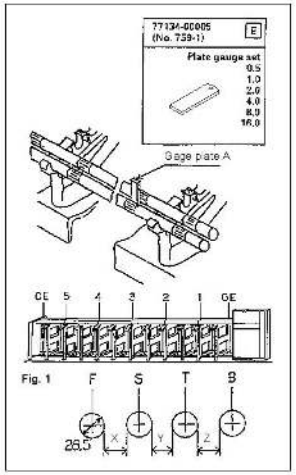

77134-00005
(No. 759-1)
E
Plate gauge set
0.5
1.0
2.0
4.0
8.0
16.0
Gage plate A
OE
5
4
3
2
1
GE
F
S
T
B
26.5
X
Y
Z

Fig. 1

[4] Setting the Roller Gage

(1) Set the roller gage in the order of **F** - **S**, **S** - **T** and **T** - **B**.

(2) Loosen the second roller slide mounting bolt. (Do not loosen it fully.)

(3) Set the distance **X** between adjacent rollers (**F** and **S**) by inserting gage plate **A** in the roller flute.

(4) Temporarily set the positions at seven places at left by using the gage plate, and tighten the slide mounting bolt.

(5) Then use the gage plate for positioning at every other stand from the GE to the OE, and tighten the second slide set bolts.

(6) Return to the GE and position the slide at remaining stands.

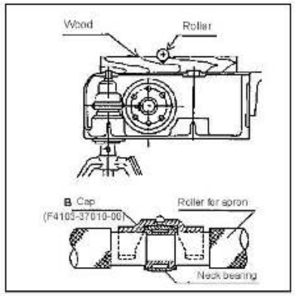
NOTE: Tighten at a natural roller position. Never adjust to the gage plate forcibly.

(7) After positioning the second rollers, set the third and back roller gages sequentially.

NOTE: Do not install the third roller apron until the end of gage setting.

(8) Roller gage setting gage plate size

- Select the gage plate according to the roller gage.
- When setting F to **S** gage to 35 m. The gage plate **A** shall be 6.5 mm.


Wood
Roller
B Cap
(F4103-37010-00)
Roller for apron
Neck bearing

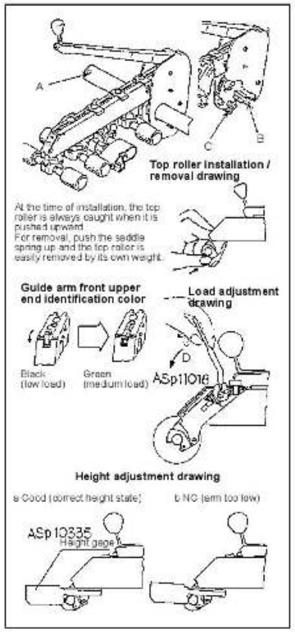
[5] Installing the Bottom Apron

(1) Lower the third roller to the wooden block on the flyer rail cover.

NOTE: Lower while seven persons hold the seven places in the figure at left. (Fig. 1)

(2) Install cap **B** at the neck bearing portion to make bearing outer race not removable, and insert aprons sequentially.

(3) Install third rollers on the frame and remove the caps.



Top roller installation / removal drawing

At the time of installation, the top roller is always caught when it is pushed upward.
For removal, push the saddle spring up and the top roller is easily removed by its own weight.

Guide arm front upper end identification color

Load adjustment drawing

Height adjustment drawing

a Good (correct height state)

b NG (arm too low)

2.1.24 Installing the Weighting Arms

[1] PK1500

[1.1] Arm Installation

(1) Insert the weighting arm to the supporting rod, and install on the roller stand.

NOTE: When passing the arm, make the bolt hole come to the front.

(2) Install the top roller on the arm.

*Install the apron and cradle on the third roller (excluding the distance clip).

(3) Temporarily position the arm visually at the center of the bottom roller flute portion and manually tighten the arm fixing bolt **B**.

(4) Use a wrench **D** and change the arm load to the intermediate load (green).

*Unify the load to intermediate (green) from the front to the back.

[1.2] Positioning the Top Rollers (Making the setting sample)

(1) Visually position the top roller of the final arm in the OE stuff to be placed above the bottom roller.

(2) Adjust the arm height.

1) Lightly tighten the fixing bolt **B**.

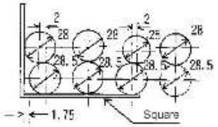
2) Tighten the height adjusting bolt **C** to obtain the state shown in height adjustment drawing **a** (arm too low).

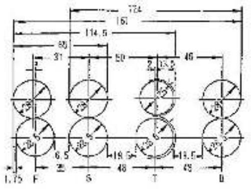
3) Strongly tighten fixing bolt **B**.

4) Turn the height adjusting bolt **b** to obtain the state shown in height adjustment drawing **a** (correct height).

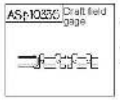
(3) Load and unload the arm 3 to 4 times to see that the arm height is as shown in **a**.

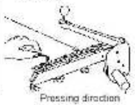
In the case of rollers with a diameter of 28.5 mm.


2
28
28
2
25
28
28.5
28.5
28.5
28.5
1.75
Square

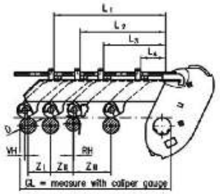

124
161
114.5
65
31
50
2
13.5
46
6.5
19.5
13.5
1.75
35
48
45
F
S
T
B

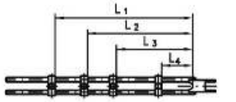
Roller gage setting drawing


AS-10336
Draft field gage



Pressing direction


L1
L2
L3
L4
D
VH
RH
Z I
Z II
Z III
GL = measure with caliper gauge



(4) Adjust the top roller position to make the front top roller protrude by 1.75 mm.

*Use a square and gage plate.

(5) Confirm front top roller parallelism.

*The protrusion shall be the same on the left and right sides.

(6) Second top rollers - back top rollers.
Measure each position with a vernier caliper for positioning.

*The figure at left shows the case of roller gages at 35 × 48 × 48.

(7) Confirm parallelism of each top roller.

(8) Adjust the draft field gage to the completely set arm.

(9) Position the element of every arm by using the field gage.

(Reference) Field gage set value calculation formula

$$L_1 = GL + VH - \frac{D}{2} - 64.5$$

$$L_2 = L_1 - Z_I - VH$$

$$L_3 = L_1 - Z_I - Z_{II} - VH - RH$$

$$L_4 = L_1 - Z_I - Z_{II} - Z_{III} - VH$$

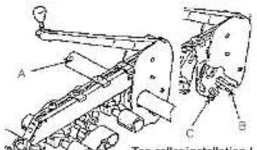
Four wires
GL = 269 + D/2

NOTE: Check parallelism of rollers and fix the elements.
Press each element against the gage from the back side to the front side.

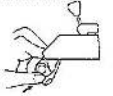
[1.3] Adjusting the Heights of All Arms

(1) Adjust the height of every arm in the same way as in [2] (2) and (3) above.

(2) Check the arm height again by loading of the weights of all arms.

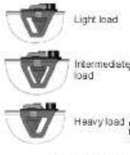


Top roller installation / removal drawing

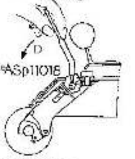


At the time of installation, the top roller is always caught when it is pushed upward.
For removal, push the saddle spring up and the top roller is easily removed by its own weight.

Arm side face Indicator position



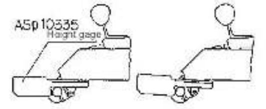
Load adjustment drawing



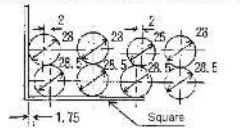
Height adjustment drawing

a Good (correct height state)

b NG (arm too low)



In the case of rollers with a diameter of 28.5 mm.



[2] PK1550

[2.1] Arm Installation

(1) Insert the weighting arm to the supporting rod, and install on the roller stand.

NOTE: When passing the arm, make the bolt hole come to the front.

(2) Install the top roller on the arm.

*Install the apron and cradle on the third roller (excluding the distance clip).

(3) Temporarily position the arm visually at the center of the bottom roller flute portion and manually tighten the arm fixing bolt **B**.

(4) Use a wrench **D** and change the arm load to the intermediate load.

*Unify the load to intermediate (green) from the front to the back.

[2.2] Positioning the Top Rollers (Making the setting sample)

(1) Visually position the top roller of the final arm in the OE stuff to be placed above the bottom roller.

(2) Adjust the arm height.

1) Lightly tighten the fixing bolt **B**.

2) Tighten the height adjusting bolt **C** to obtain the state shown in height adjustment drawing **a** (arm too low).

3) Strongly tighten fixing bolt **B**.

4) Turn the height adjusting bolt **b** to obtain the state shown in height adjustment drawing **a** (correct height).

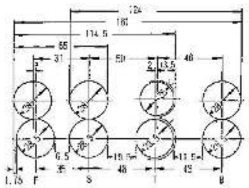
(3) Load and unload the arm 3 to 4 times to see that the arm height is as shown in **a**.

(4) Adjust the top roller position to make the front top roller protrude by 1.75 mm.

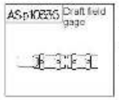
*Use a square and gage plate.

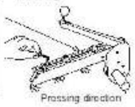
(5) Confirm front top roller parallelism.

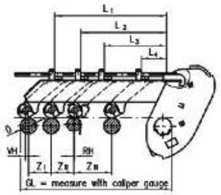
*The protrusion shall be the same on the left and right sides.

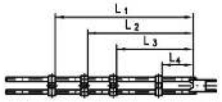

124
180
114.5
65
37
50
2
13.5
48
6.5
19.5
13.5
1.75
F
35
S
48
T
48
B

Roller gage setting drawing


Draft field gage


Pressing direction


L1
L2
L3
L4
D
VH
RH
Z I
Z II
Z III
GL = measure with caliper gauge



(6) Second top rollers - back top rollers
Measure each position with a vernier caliper for positioning.

*The figure at left shows the case of roller gages at 35 × 48 × 48

(7) Confirm parallelism of each top roller

(8) Adjust the draft field gage to the completely set arm

(9) Position the element of every arm by using the field gage.

(Reference) Field gage set value calculation formula

$$L_1 = GL + VH - \frac{D}{2} - 64.5$$

$$L_2 = L_1 - Z_{I} - VH$$

$$L_3 = L_1 - Z_{I} - Z_{II} - VH - RH$$

$$L_4 = L_1 - Z_{I} - Z_{II} - Z_{III} - VH$$

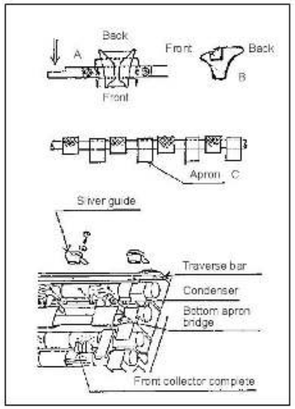
Four wires
GL = 259 + D/2

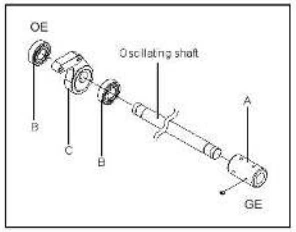
NOTE: Check parallelism of rollers and fix the elements.
Press each element against the gage from the back side to the front side

[2.3] Adjusting the Heights of All Arms

(1) Adjust the height of every arm in the same way as in [2] (2) and (3) above

(2) Check the arm height again by loading of the weights of all arms.


Back
A
Front
Front
Back
B
Apron C
Sliver guide
Traverse bar
Condenser
Bottom apron bridge
Front collector complete


OE
Oscillating shaft
A
B
C
B
GE

2.1.25 Installing Small Roller Parts

[1] Installing Apron Guides, Tenser Bars, etc.

(1) Install the apron guide **A** on the supporting bar. (Do not install on the frame.)

NOTE:

- Do not err the mounting direction.
- Tighten the set screw to the degree allowing slight guide movement.

Fix the apron guide after checking no contact with the bottom roller in no-load running.

(2) Move the apron **C** to the roller small diameter portion (staged portion).

(3) Pass the bottom apron bridge **B** through the apron.

NOTE: Do not err the bridge front to rear direction.

(4) Fit the bridge into the groove on the slide.

(5) Move the apron to the regular roller position.

(6) Install the supporting bar for apron guide.

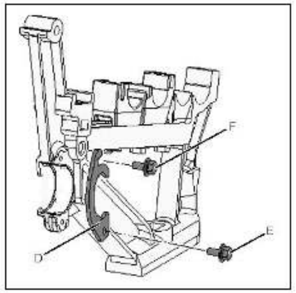
(7) Install the bearing cap that has been removed and kept.

[2] Installing the Oscillating Shaft

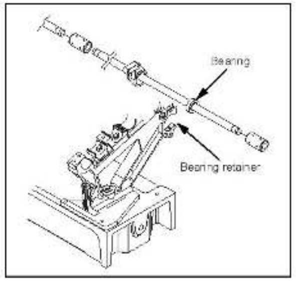
(1) Install coupling **A**, bearing **B**, oscillating lever **C** and bearing **B** in this order from the GE on each oscillating shaft, and arrange them on the rear side of the frame.

NOTE: Do not connect shafts in this stage.

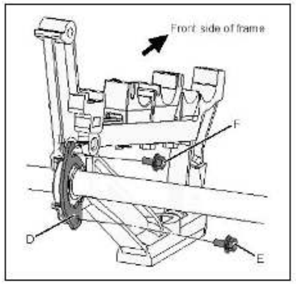
OE	6	5	4	3	2	1	Sequence	Specification
2680	→	→	→	→	→	2600	140 spindles	520 stuffs
2680		2080	→	→	→	2600	120 spindles	
2680		1040	→	→	→	2600	108 spindles	
2680			3120	→	→	2600	104 spindles	
2680			2680	→	→	2600	100 spindles	
2680			2080	→	→	2600	98 spindles	
2720		2720	→	→	→	2640	144 spindles	440 stuffs
1400		1400	→	→	→	2640	132 spindles	
2720			2720	→	→	2640	120 spindles	
1400			1400	→	→	2640	108 spindles	



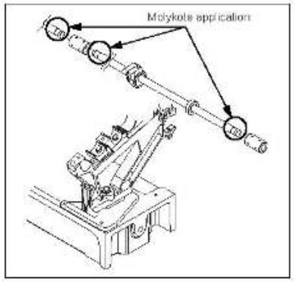
(2) Temporarily install bearing fixing plate **D** on the rear face of the roller stand by means of flange bolts **E** and **F**.



(3) Place the first oscillating shaft Assy from the GE on the bearing retainer on the rear side of the roller stand, and place each bearing on the bearing retainer.


Front side of frame
F
D
E

(4) Push the oscillating shaft Assy toward the front side of the frame. While holding it with bearing plate **D** in contact with flange bolt **F**, tighten flange bolts **E** and **F**. Install the second shaft Assy and on the same way.


Molykote application

NOTE: Before connecting the oscillating shafts with the coupling, apply Molykote on each shaft end.

2.1.26 Installing the Clearer Waste Collector (CWC)

[1] Installing the Trough (M-shaped section rail)

[1.1] Preparation before installation

(1) Attach anti-vibration tape **1** (12.7 × 50 mm) to the trough mounting faces of the inside frame and spring piece.

(2) Install the trough support & clearer waste guide **2** to the rear end of the OE roller beam on the side of the OE frame.

(3) Arrange the troughs with the 10 mm-holed side facing towards the creel and with the non-holed side facing towards the roller beam.

(4) The lengthwise installation position of troughs differs depending upon the FL specifications. According to the table given below, arrange the troughs starting from the OE.

NOTE: At the first and last installation positions starting from the GE, use trough **3** and trough **4**, respectively, each of which is exclusively designed to have a cutout for that position.

NOTE: Be sure to arrange the troughs (except for the first- and last-position troughs) so that every trough is supported by the spring piece at least one point.

Trough Arrangement Table (Unit: mm)

○: Denotes the installation position of belt supports.

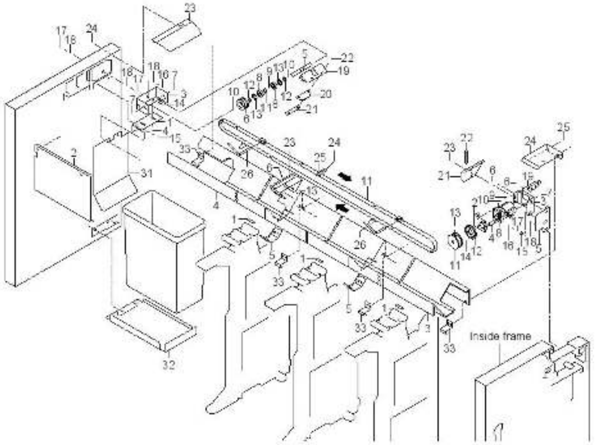
11	10	9	8	7	6	5	4	3	2	1	Order of troughs	FL
1800 OE ○	1800	1070 ○	1070	1800 ○	1800	1800 ○	1800	1800 ○	1800	1800 GE	140 spindles	520-stuff
—	—	1800 OE ○	1340	1800 ○	1800	1800 ○	1800	1800 ○	1800	1800 GE	120 spindles	
—	—	—	1800 OE	1580 ○	1800	1800 ○	1800	1800 ○	1800	1800 GE	108 spindles	
—	—	—	—	1800 OE ○	1820	1800 ○	1800	1800 ○	1800	1800 GE	96 spindles	
—	—	1800 OE ○	1800	1800 ○	1800	1800 ○	1800	1580 ○	1800	1800 GE	144 spindles	440-stuff
—	—	1800 OE ○	1800	1800 ○	1800	1560 ○	1560	740 ○	1800	1800 GE	132 spindles	
—	—	—	1800 OE	1800 ○	1800	1800 ○	1800	740 ○	1800	1800 GE	120 spindles	
—	—	—	—	1800 OE ○	1800	1800 ○	1800	1220 ○	1800	1800 GE	108 spindles	
—	—	—	—	—	1800 OE	1800 ○	1800	1700 ○	1800	1800 GE	96 spindles	

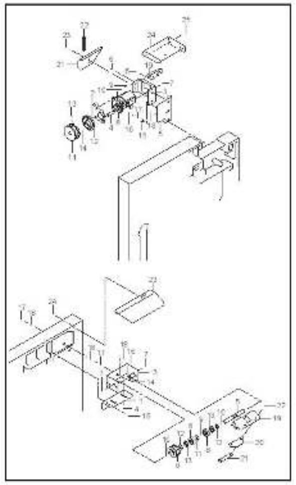
[1.2] Installing the troughs

(1) Install the troughs in order starting from the CE. When doing so, bring the ends of the troughs into tight contact with each other and secure the troughs to the joints at the same time.

(2) Always secure each trough with brackets **5** and **33**. Merely putting troughs without securing is DANGEROUS; they may drop.

NOTE: Circle ○ in the above table denotes the installation position of belt supports **6** should be secured to the joints together with the troughs.


23
17
18
24
18
17
16
7
3
14
4
15
33
2
31
5
22
19
10
12
8
9
13
20
21
11
23
24
25
26
4
1
5
33
26
6
3
32
22
23
21
6
25
24
13
14
12
11
16
15
Inside frame
33



[2] Installing the CWC Motor and Related Components

[2.1] Installing the CWC motor

(1) Install the motor assembly to the gear-head inside frame. (When the CWC motor **8** is delivered from the factory, it is assembled together with bracket **9** and pulley **10**.)

(2) Temporarily install belt **11** since the pulley height relative to the trough is to be adjusted when adjusting the belt tension later.

(3) Set V-letter bent plate **12** between the pulley and gear-head inside frame, and then put the inside frame on the trough.

[2.2] Installing the belt and tension pulley

(1) Check the arrow mark put on the inside of the belt. Install the belt so that the belt loop moves clockwise when viewed from the front of the FL.

(2) Remove either one of screws **13** from the belt support (that is installed to the trough joint) and then pass the belt through the belt support.

(3) Install L-shaped bracket **14** onto the OE frame.

(4) Remove tension pulley **15** from bracket **18** by removing bolts **17** from both ends of shaft **16**.

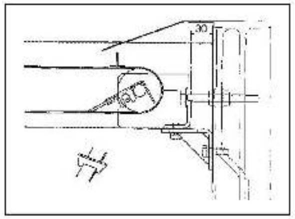
(5) Insert adjustment bolt **19** through the hole provided at the center of bracket **18** and set nut **20** to adjustment bolt **19**.

(6) With the belt being put over the tension pulley, install the shaft to the bracket.

(7) Temporarily install plate **21** that has a belt-inside cleaning sheet to the bracket.

Now, the tension pulley is ready to install the FL100.

(8) Insert adjustment bolt **19** through the hole provided in the OE frame and set nut **22** to it.

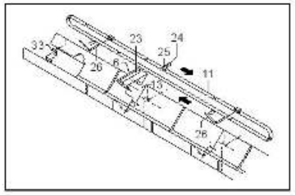


[2.3] Adjusting the belt tension

Check that the belt is put over the OE drive pulley in the correct direction.

(1) Turn adjustment bolt **19** so that the distance from the OE frame machined side to the rear side of the tension pulley bracket becomes 30 mm.

(2) Check that the tension pulley is not inclined and then secure the bracket. Firmly tighten nuts **20** and **22** on adjustment bolt **19**



[2.4] Preparation before running the CWC

(1) Attach guide tape **23** (20 mm wide × 185 mm long) to the OE side of the belt supports installed on the trough joints.

(2) Attach guide tape **25** (20 mm wide × 70 mm long) to scraper **24** so that the whole adhesive face becomes tightly attached

(3) Insert two cleaner scrapers **26** (400 mm long) designed for cleaning the front and rear slopes of the trough into the belt as shown at left.

Turn the belt loop clockwise until the scrapers come down to the lower belt path. Adjust their position so that they come into full contact with the entire surface of the front and rear slopes, and then glue those scrapers onto the belt.

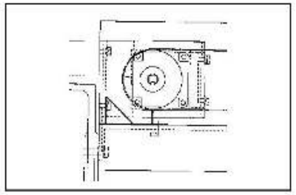
NOTE: Be sure to secure the scrapers to the belt with glue. Otherwise, they may slip out of place.

[3] Running the CWC for Adjustment

If the CWC becomes ready to run after wiring of the CWC motor, use the CWC run switch to check the motor rotation direction. Also check the positional relationship between components when the CWC is in operation.

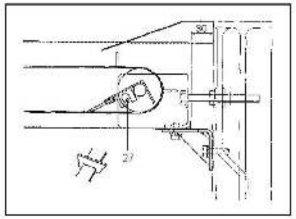
Be sure to stop the motor before starting adjustment jobs.

[3.1] Adjusting the Drive Pulley Position



(1) Adjust the position of the drive pulley so that the gap between the belt scrapers and the bottom of the trough becomes almost 0 mm.

NOTE: Do not bring the belt scrapers into too tight contact with the bottom of the trough. Doing so may bend the scrapers and their service life will be shortened.



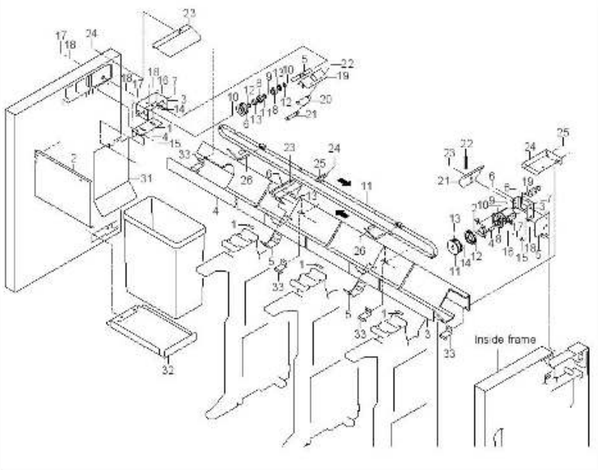
(2) At the OE, secure the drive pulley with bolt **27** so that the lower end of the belt-inside cleaning sheet becomes into light contact with the inside of the belt.

(3) At the GE, after installing the motor and pulley cover **28**, run the motor and check that the cleaner scrapers become into full contact with the slope of the trough after turning around the drive pulleys.

TIP: The scrapers are supported by belt guide **29** provided at the belt entry section of the cover so that they are stabilized in posture, and the scrapers themselves are specially structured. This design allows the scrapers to become into full contact with the slope of the trough after turning around the drive pulleys.

(4) At the OE, install the tension pulley cover **30** and waste guide **31**.

(5) Install box base **32** to the OE frame.



[4] Installing the Blower Unit (Option)

[4.1] Installing the blower duct

(1) Install floor fan **1** to the base.

(2) Install duct bracket **2** to the cable duct.

(3) Install the blower ducts starting from the OE in the numerical order.

(4) Set flexible joint **3** to the duct.

(5) Set flexible pipe **4** to the flexible joint.

(6) Wind sponge tape **5** and duct tape **6** around the blower duct to prevent air leakage.

(7) Install cover **7** to each end of the blower duct and then tape them.

[4.2] Installing the filter cleaning brush of the blower inlet

In order to prevent air intake flow from decreasing due to fly or fleece accumulating on the inlet filter, install cleaning brush **11** to the inlet filter. The brush will move up and down for cleaning.

(1) Remove four bolts **8** out of six bolts that secure the blower casing, and then install filter cleaner base **9**.

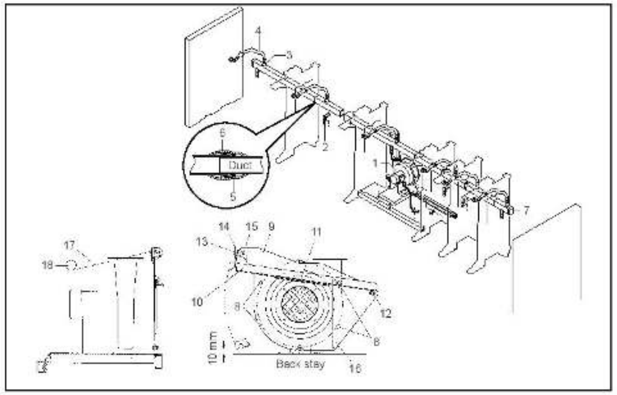
(2) Set brush **11** to lever **10**, and then fit stud **12** into the base.

(3) Screw socket-head bolt **13** into pulley **14** until the pulley lightly rotates, then secure the bolt with lock nut **15** from the opposite side.

(4) Set spring **16** to pull down the lever.

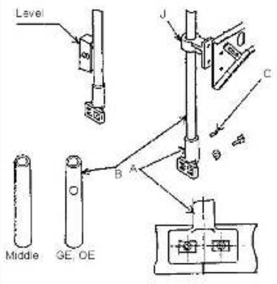
(5) Hook the loop of wire rope **17** on the left end of the lever, put the wire rope over the pulley, and then secure the other end of the wire rope to lifter shaft **18** with the band.

(6) Adjust the wire rope so that the left bottom end of the lever comes 10 mm above the top of the back stay when the bobbin rail is in the lowermost position.



2.1.27 Installing the Creel

[1] Creel Pillar Installation



(1) Temporarily install the creel pillar bracket **A** on the angle.

(2) Fit the creel pillar **B** to the bracket and tighten set screw **C**.

NOTE:

- Bring the pillar into close contact with the bottom of the bracket.
- The pillars are provided in two types: for OE and GE and for middle portion.

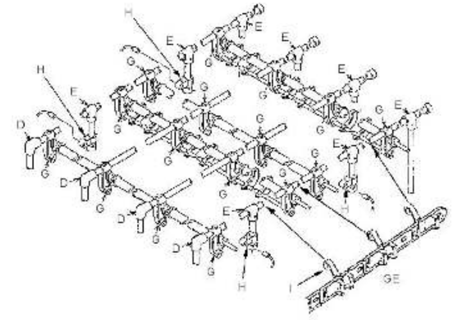
(3) Apply a level to the pillar **B** to confirm perpendicularity and fix the bracket in the center of the screw.

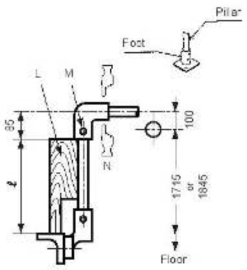
(4) Install the brackets **D** and **E**, feed roller bracket **G** and bracket for chain cover **I** on the creel pillar.

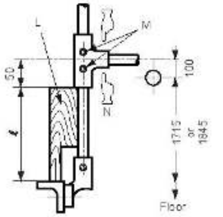
In this step, temporarily install phototube bracket **H**.

NOTE:

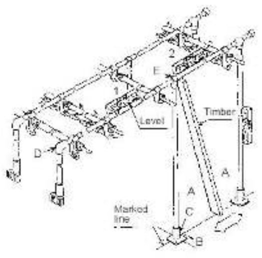
- Three types for GE, middle, and OE are made by different combinations of parts.
- Refer to the floor plan submitted to the customer for the parts mounting positions.
- The parts mounting positions for the GE shall be determined referring to the chain cover.
- The figure below shows a sample.







With BS cleaner or preparatory type



(5) Place the bracket for chain cover **J** in the GE pillar.

(6) Install the creel pillar (ℓ = 1790 or 1920) on the foot, and tighten one set screw before placement on the floor.

(7) Install the creel pillars prepared in step (4) sequentially from the GE to the OE.

*Tighten two set screws **K**.

[2] Adjusting the Creel Pillar Height

(1) Determine the distance between the angle and bracket.

1) Prepare the plate gage **L** and apply it to the pillar.

Plate gauge ℓ dimension

Feed roller height	ℓ	
	Normal	With BS cleaner or preparatory type
1715	464	499
1845	594	629

2) Slightly loosen the set screw **M** and tap the **N** portion with a copper hammer for adjustment to the plate gage.

3) Strongly tighten two set screws **M**.

4) Adjust the position in the same way at other places.

(2) Match pillars **A** with the marked line and check perpendicularity before tightening the set screw of bracket **D**.

(3) Place a level on the pillar **A** and adjust the height by moving the pillar up or down with the frame side as the datum.

1) Loosen set screw **B** on foot.

NOTE: Insert pillar **A** to the root of bracket **E**.

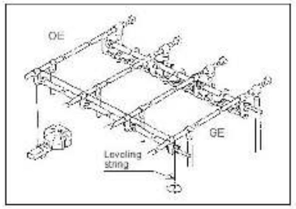
2) Adjust the height by moving the timber in the direction of the arrow.

3) Make adjustment in the order of **1** and **2**.

4) Tighten all set screws for foot **C** and bracket **E** for fixing.

5) Adjust the height sequentially from the GE to the OE.

[3] Positioning the Feed Rollers



(1) Determine the position of each bracket on the GE according to the creel dimension in the floor plan.

(2) Match the OE bracket position with that on the GE.

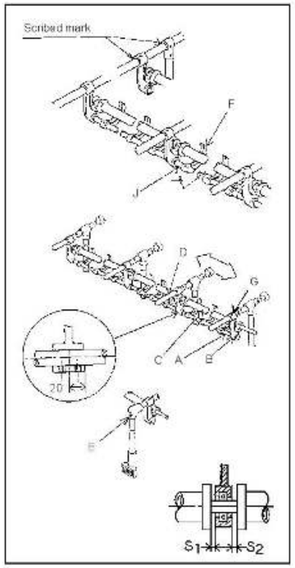
(3) Stretch a leveling string from the GE to the OE and position the intermediate brackets.

*Lightly tighten the set screws.

(4) Position the brackets in the same way from the first roller to the final roller.

(5) Scribe the positioning mark for bracket positioning on the pillar.

[4] Installing the Feed Rollers



(1) Fit separator **F** on the separator suport pipe **J**.

*Refer to the can layout in the floor plan for the number of separators to be installed.

(2) Install the separator support pipe **J** for the final roller on the feed roller bracket **B**.

NOTE:

- Insert the separator support pipe equally into the bracket boss (20 mm).
- Loosen the bracket **B** pipe set screws beforehand.

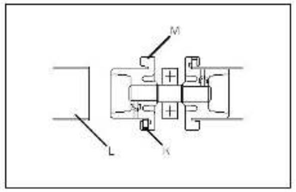
(3) Install the GE feed roller complete **C** on the bracket **B**.

1) Move pillar **D** to bring the bearing to the center of the bracket. (Make S_1 and S_2 equal.)

2) When moving the pillar **D**, loosen set screws on brackets **E** and **B**.

(4) After checking alignment of the bracket **B** with the scribed mark on the pillar, tighten the set screw **F**.

NOTE: The tightening torque should be 4.9 to 5.9 N•m (50 to 60 kgf•cm). Applying excessive torque may break the bracket which is made of resin.



(5) Install the final rollers in the same way to the OE.

NOTE:

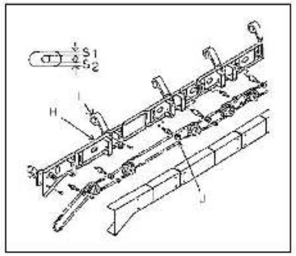
- When connecting the pipes, follow the steps below and take care not to break their flanges which are made of resin.

1)Loosen screw **K** on flange **M**.

2)Fully insert pipe **L** into the flange, and torque screw **K** to 1.96 N•m (20 kgf•cm).

- Do not tap the flange with a hammer. (The flange may be broken.)

[5] Installing the Chain Cover



(1) Install the chain cover **H** on the bracket **I**.

*Install to make clearances S_1 and S_2 between the roller shaft and cover equal.

(2) Install the chain wheel.

(3) Install the chain.

(4) Install the guide roller **J** and adjust the chain tension.

(5) If adjustment by the guide roller is insufficient, move the OE feed roller position a little (2 to 3 mm).

2.1.28 Installing the Top and Bottom Clearers

[1] Top Clearer Installation

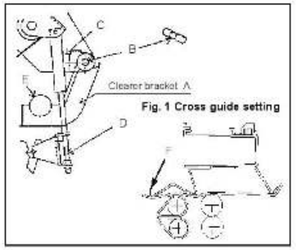

C
B
E
Clearer bracket A
D
F

Fig. 1 Cross guide setting

(1) Insert the hinge pin **B** into the hole in the clearer bracket **A**

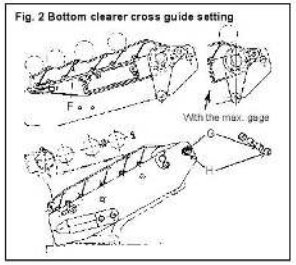
(2) Install the top clearer **C**

NOTE: Make the joint rod **D** protrude from the supporting rod **E**.

(3) Set the cross guide **F** in the center of the top roller as shown in Fig. 1.

[2] Bottom Clearer Installation

Fig. 2 Bottom clearer cross guide setting

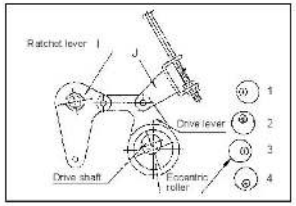

F
With the max. gage
G
H

(1) Install the clearers for one stuff. (No adjustment using the roller gage is required.)

(2) Insert the hinge pin **G** into the hole in the roller stand

(3) Fit collar **H** to the hinge pin, and install the clearer frame on the pin.

[3] Connecting the Drive Block


Ratchet lever I
J
Drive lever
Drive shaft
Eccentric roller
1
2
3
4

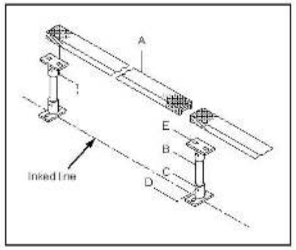
(1) Connect the bottom clearer ratchet lever I with the drive lever

(2) Connect the top clearer joint rod bracket **J** with the drive lever.

NOTE: Do not tighten excessively as the hinge pin is thin. (The threaded portion may be damaged.)

(3) Set the eccentric rollers with phase offset of 90° each--**1** to **4**. (For averaging the drive torque)

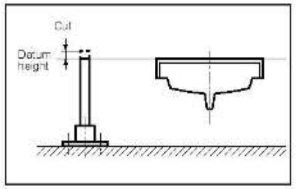
2.1.29 Installing the Foot Steps



(1) Ink the footstep pillar positions by referring to the "DIGGING PLAN" drawing.

(2) Fix bracket **C** on the floor according to the inking.

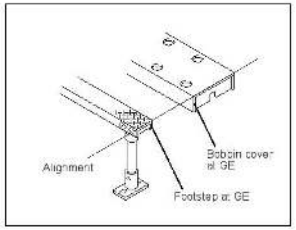
(3) Install pillar pipe **B** and bracket **E** on bracket **C**, and fix them by setscrew **D**.



(4) Adjust the height of the foot step pillar pipe installed in (3) above as follows.

Adjust the top face of the bobbin rail in the same level with the top face of the lowest pillar pipe as the datum height. Cut the excess portions of other pillar pipes.

(5) Install foot step **A** on the pillar and temporarily tighten the set bolt.

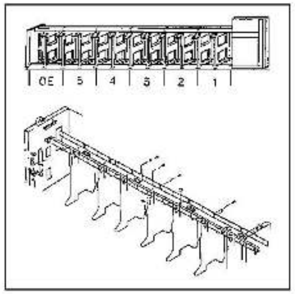


(6) After installing all footsteps from the GE to the OE, align the edge of the footstep at the GE with the bobbin rail cover edge at the GE.

(7) Fix the footsteps with the pillars sequentially fully to the OE.

2.1.30 Wiring for the FL

[1] Installing the Wire Ducts



(1) Install the wire duct to the spring piece. (See the figure at left.)

(2) Attach a grommet to the wire duct.

1) Install the rubber brush after making a slit with a nipper.

2) Use the cable connector for push-button switch cables.

(3) Install the terminal blocks on the wire duct and OE frame. (Refer to the figure on the left and the parts catalogue for the installation positions.)

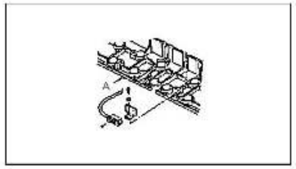
[2] Wiring inside the wire duct

(1) Pass the cables from the OE head through the duct and connect them to the terminal block.

(2) Connect the interconnection cables between terminal blocks.

(3) Connect the push-button switch cables to the terminal block.

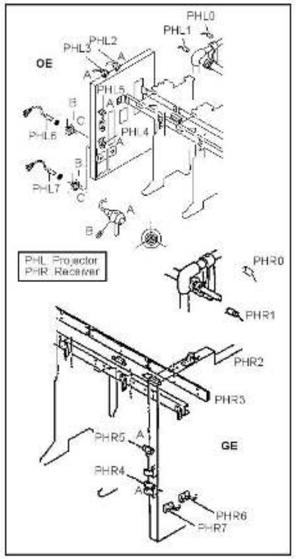
(4) Fasten the cables onto the spring pieces with wiring clamps to prevent them from coming into contact with the chain.



NOTE:

- Install the switch on the bracket so as to direct the switch cable **A** toward the OE.
- Install the switch before installing the flyer shaft.

[3] Installing the PH Sensor (The number of PH sensors varies with the customer.)



(1) Install the holder **C** for the bobbin detecting PH sensor on the OE at the end of rough assembly.

(2) Install O-rings on the grooves of the broken-roving/joint photo stand **A** and bobbin detecting sensor holder **C**, and insert the PH sensors. Tighten setscrew **B** to position each PH sensor in the center.

(3) Install the PH sensors (PHR 1 to 7 and PHL 1 to 7) in the specified positions.

(4) Install bobbin detecting PH sensors PHR 6 and PHR 7 on the brackets in the GE head.

NOTE: Do not let the glass portion of the PH sensor protrude from the bracket.

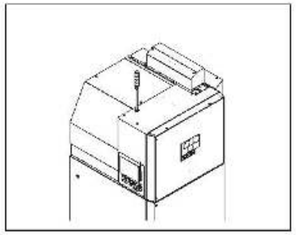
(5) Connect PHL 0 to 7 to terminal block TB150 of the OE frame.

NOTE: Be sure to confirm that the mark tube numbers on the connecting cables match.

(6) Fasten all the electrical cables with wiring clamps so that they do not come into contact with the rotating sections.

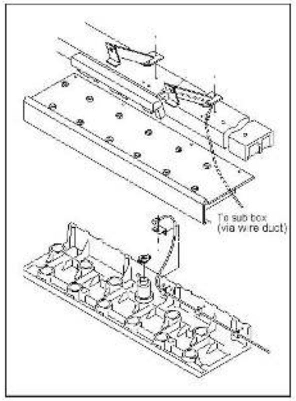
NOTE: Wire the signal and power cables sepa-

[4] Installing the Signal Lamp



(1) Attach the signal lamp to the top of the of the GE head.

(2) Connect the lead wire of the signal lamp to connector CN30A on the upper left of the main control board inside the control box (A-BOX).



[5] Installing the Tension Sensor (PH0)

(1) Route the tension sensor wire through the tension sensor bracket, roller beam, and flyer rail in this order as shown at left.

(2) Install the tension sensor bracket on the roller beam, and then install the sensor on the bracket.

(3) Connect the connector and terminal to CN58 of the main control board I/02 in the Control Box (A-BOX) and also to terminal block TB120.

NOTE: When routing the wire, do not bend the connector section forcedly.

NOTE: Adjust the tension sensor bracket so that the tension sensor does not become twisted.

[6] Installing the Flyer Optimum Position Stop Proximity Switch (PRS1)

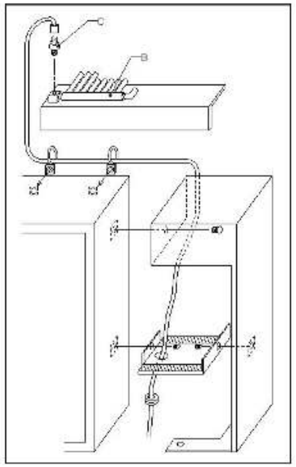
(1) Set a dog to the flyer gear.

(2) Install the proximity switch (flyer optimum-stop switch) to the flyer rail.

(3) Connect the switch to terminal block TB120 in the control box (A-BOX).

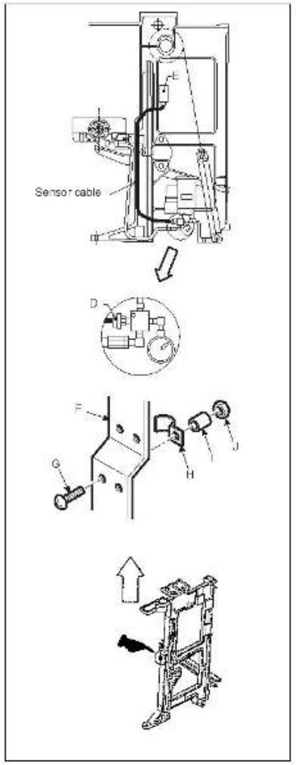
[7] Installing the Grease Pressure Sensors

[7.1] Grease pressure sensor (PS2) for the flyer gear and draft gearing lubrication systems



(1) Install grease pressure sensor **C** to GE distribution panel **B** mounted on the draft gearing beam.

(2) Install wiring between the sensor and the control box (A-BOX) and then connect it to terminals 117 and E12 of terminal block TB120.



[7.2] Bobbin gear grease pressure sensor (PS3)

(1) Install grease pressure sensor **D** as illustrated at left.

(2) Lay the sensor cable along the face of spring piece F and secure it in three places with saddles as shown in the diagram. Then put the cable into wire duct E.

(3) Install wiring from the wire duct to the control box (A-BOX) and then connect it to terminals E12 and 119 of the terminal block.

G:Truss machine screw (83107-60035)

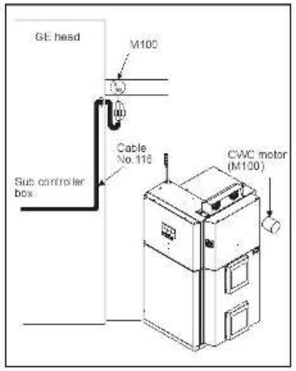
H:Saddle (68520-00000)

I:Collar (74020-08001)

J:Hexagonal nut (84101-00600)

2.1.31 Wiring for the Motors

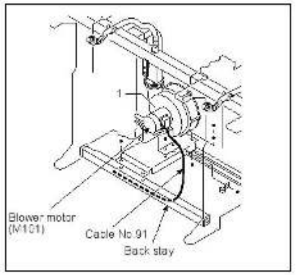
[1] M100 (CWC Motor) Wiring


GE head
M100
Cable No.116
Sub controller box
CWC motor (M100)

(1) Connect electrical cable (mark tubes: 352, 353, 354) to the lead wire butt of the motor (M100).

NOTE: House sagging cables in the duct to leave no sag outside.

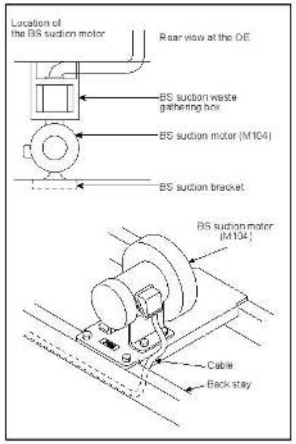
[2] M101 (Blower Motor) Wiring (Option)


1
Blower motor (M101)
Cable No.91
Back stay

(1) Connect electrical cable (mark tubes: U101, V101, W101, E) to the motor (M101) terminal block.

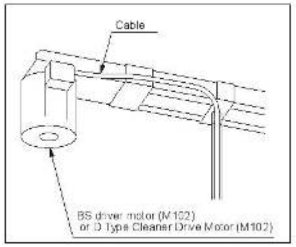
[3] M104 (BS Suction Motor) Wiring (Option)

(1) Connect electrical cable (mark tubes: U104, V104, W104, E) to the BS suction motor (M104) terminal block.


Location of
the BS suction motor
Rear view at the OE
BS suction waste gathering box
BS suction motor (M104)
BS suction bracket
BS suction motor (M104)
Cable
Back stay

[4] M102 (Blow Cleaner Drive Motor) Wiring (Option)

(1) Connect electrical cable (mark tubes: U102, V102, W102, E) to the motor terminal block.


Cable
BS driver motor (M102)
or D Type Cleaner Drive Motor (M102)

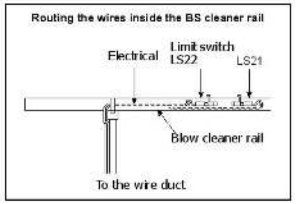
2.1.32 Other Wiring

[1] LS21 (Used to Stop the Blow Cleaner) Wiring (Option)

(1) Connect electrical cable (mark tubes: 142, E12) to the limit switch terminal block.

(2) The cable (mark tubes: 142, E12) should be fed through the inside of the blow cleaner rail from the hole near the LS21 as shown in the diagram to the left.

(3) Lay the cable along the blow cleaner rail pillar to the wire duct at the rear.


Routing the wires inside the BS cleaner rail

[2] LS22 (for Suction) Wiring (Option)

(1) Connect the electrical cable (mark tubes: 144, E12) to the limit switch terminal block.

(2) The cable (mark tubes: 144, E12) should be fed through the inside of the blow cleaner rail from the hole near the LS22 as shown in the diagram to the left.

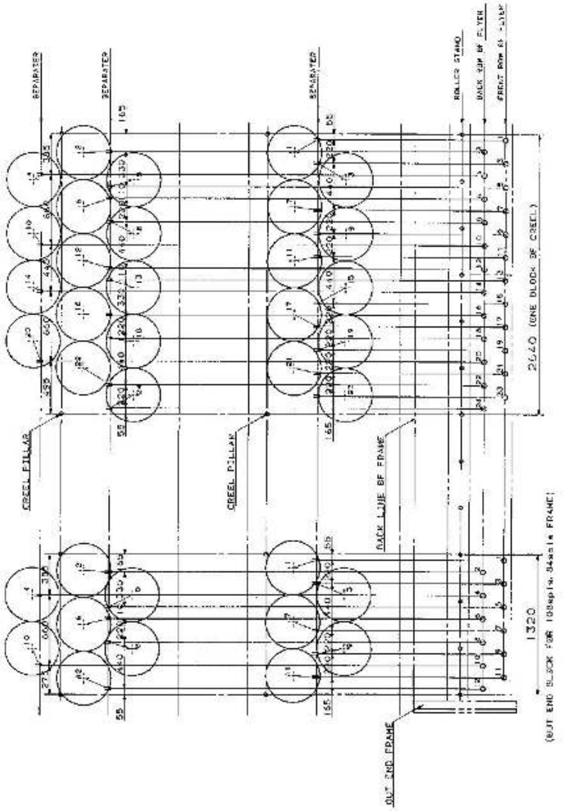
(3) Lay the cable along the blow cleaner rail pillar to the wire duct at the rear.

[3] SOL9 (for Damper) Wiring (Option)

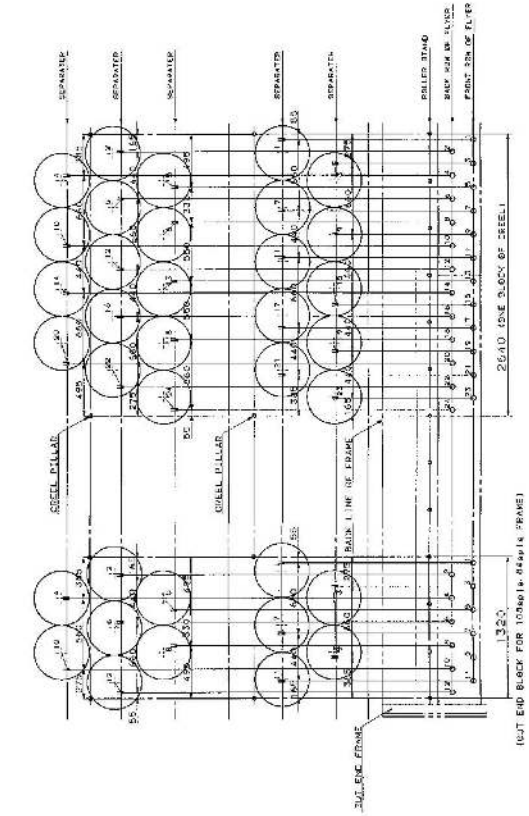
(1) Connect the electrical cable (mark tubes: P24, 422) to the lead wire of the solenoid.

(2) The cable route will pass through the backstay.

2.1.33 Can Layout (3-line)


SEPARATER
SEPARATER
SEPARATER
ROLLER STAND
BACK ROW OF FLYER
FRONT ROW OF FLYER
CREEL PILLAR
CREEL PILLAR
BACK LINE OF FRAME
OUT END FRAME
2640 (ONE BLOCK OF CREEL)
1320
(OUT END BLOCK FOR 108spls. 84spls FRAME)

2.1.34 Can Layout (5-line)


SEPARATER
SEPARATER
SEPARATER
SEPARATER
SEPARATER
ROLLER STAND
BACK ROW OF FLYER
FRONT ROW OF FLYER
CREEL PILLAR
CREEL PILLAR
BACK LINE OF FRAME
OUT END FRAME
2640 (ONE BLOCK OF CREEL)
1320
(OUT END BLOCK FOR 108spls.84spls FRAME)

2.1.35 Installation and Adjustment of Flyer Safety Cover (Option)

⚠ CAUTION

The flyer safety cover is supported by the frictional braking force generated by the Belleville spring washers. Therefore, be sure to set the Belleville spring washers when mounting the cover.
When opening the cover, ensure that the cover comes into contact with the pipe. Otherwise the cover may drop.

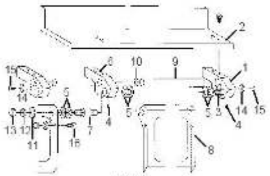


Fig. 1

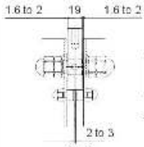


Fig. 2

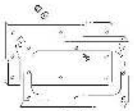


Fig. 3

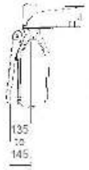


Fig. 4

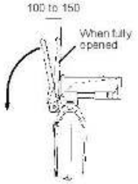


Fig. 5

(1) Tentatively fix the bracket **1** (with two M6 screws) to the flyer rail **2** at the gear end.
(2) Insert the shaft **3** into the tentatively tightened bracket, and fix it with the set screw **4**. Then, fit two thrust washers **5** onto the shaft.
(3) Insert the shaft **7** into the intermediate bracket **6** (without two M6 screws) and fix the shaft with the set screw **4**. Then, fit two thrust washers **5** onto the shaft.
(4) Fit a hole of the cover **8** onto the shaft **3** and the other hole onto the shaft **7**. Then, tentatively tighten the bracket **6** to the flyer rail **2**.
(5) Insert the pipe **9** into the holes of the two brackets. (Adjust the pipe overall length using the washer **10**.)
(6) By repeating the above procedure, mount the covers, brackets, and pipes sequentially.
(7) After setting the Belleville spring washer **11**, tentatively tighten the last cover with the nuts **12** and **13**.
(8) Adjust the clearance between all the covers and brackets within the range from 1.6 to 2 mm. Then, fix the brackets to the flyer rail. (Fig. 2)
(9) Mount the plastic plate to each cover. (Fig. 3)
(10) Mount the Belleville spring washers **14** and screws **15** to prevent the pipes from coming off.
(11) Mount the eccentric stopper pins **16** to each cover.
(12) Adjust the eccentric stopper pin position to provide a clearance of 135 to 145 mm between the flyer spindle end and the closed cover end. (Fig. 4)
(13) Open up the cover fully and gradually close it to find the point where the cover falls by its weight when you release the cover. (The point will be about 80 mm ahead from the full-open position before you tighten the Belleville-spring.)
Tighten the Belleville spring washer **11** with the nut **12** while adjusting its tightening torque so that the cover falls within the range from 100 to 150 mm. After adjustment, tighten the nut **13** to lock the Belleville spring. (Fig.5)

Section 3.1
Adjustment

3.1.1 Inspection & Adjustment before Test Run 3.1-2
- [1] Tightness of Adjustment Screws and Lock Nuts 3.1-2
- [2] Levelness of Bobbin Rail 3.1-3
- [3] Flyer Installation Direction and Engagement of Flyer Drive Wheels and Flyer Gears 3.1-4
- [4] Engagement of Bobbin Drive Wheels and Bobbin Gears 3.1-5
- [5] Double-carrier gear meshing inspection 3.1-6
- [6] Engagement of Change Wheels 3.1-7
- [7] Timing Belt Tension 3.1-8
- [8] Door Safety Switches 3.1-19
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3.1.2 Powering-on and Checking the Voltage Levels 3.1-18
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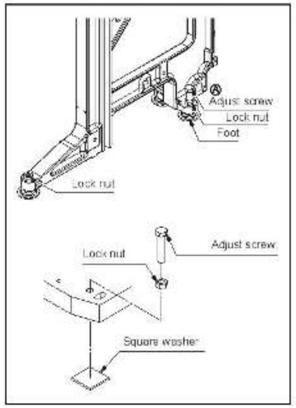
3.1 Adjustment

3.1.1 Inspection & Adjustment before Test Run

⚠ WARNING

> Observe the safety rules given in
>
> Section S.1, S.1.2, "Rules for Safe Operation"
>
> S.1.3, "Rules for Maintenance"
>
> S.1.4, "Rules for Operating or Checking the Electrical Devices."

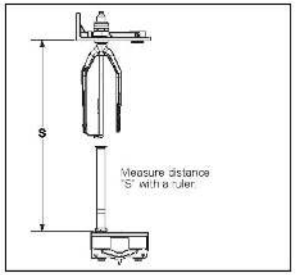

Ⓐ
Adjust screw
Lock nut
Foot
Lock nut
Adjust screw
Lock nut
Square washer

[1] Tightness of Adjustment Screws and Lock Nuts

(1) Check that the adjustment screws and lock nuts on the GE base are not loose.

(2) Lightly tap the foot Ⓒ on the middle of the GE base with a spanner to check that the adjustment screws Ⓐ are tightly fitted.

(3) Attempt to tighten lock nuts Ⓑ on the middle of the GE base with a spanner to check them for looseness.



[2] Levelness of Bobbin Rail

(1) Jack the bobbin rail at the GE only. Remove any other jacks.

(2) Measure distance **"S"** at each of pieces from the GE to the OE.
The **"S"** should be the GE reference distance ±1 mm.

(3) If the measured distance **"S"** is out of the above specification, proceed to the steps below.

(4) Jack the joints of the bobbin rail, then loosen the tightening bolts of the lifter pinions.

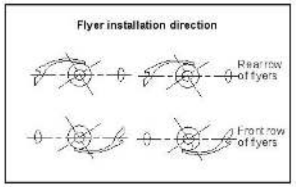
(5) Correct the distance **"S"** by using those jacks.

(6) Turn the lifter pinion by 2 to 3 teeth.

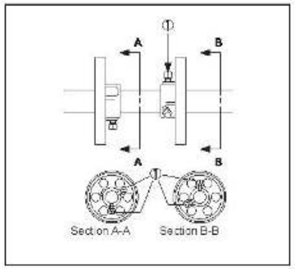
(7) Turn the lifter pinion in the direction of the up-movement of the bobbin rail, then tighten the bolts.

(8) Remove the jacks and check distance **"S"** again.

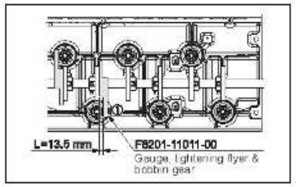
[3] Flyer Installation Direction and Engagement of Flyer Drive Wheels and Flyer Gears


Flyer installation direction
Rear row of flyers
Front row of flyers

(1) Check that the flyers are installed as shown at left.


①
A
B
A
B
Section A-A
Section B-B

(2) Check that setscrews ① on the adjacent drive wheels are symmetrical as shown at left.

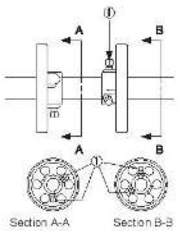

①
L=13.5 mm
F8201-11011-00
Gauge, tightening flyer & bobbin gear

(3) Check the installation position of the flyer drive wheels ② by using the gauge (F8201-11011-00).

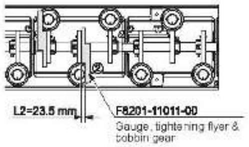
(4) Check the backlash between all flyer drive wheels and flyer gears. The backlash in the front row of flyers should be equal to that in the rear row.

(5) To adjust the backlash, move the drive shaft to the front or rear.

[4] Engagement of Bobbin Drive Wheels and Bobbin Gears


①
A
B
A
B
①
Section A-A
Section B-B

(1) Check that setscrews ① on the adjacent drive wheels are symmetrical as shown at left.

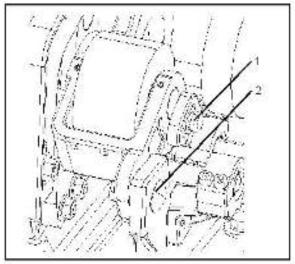

②
L2=23.5 mm
F8201-11011-00
Gauge, tightening flyer & bobbin gear

(2) Check the installation position of the bobbin drive wheels ② by using the gauge (F8201-11011-00).

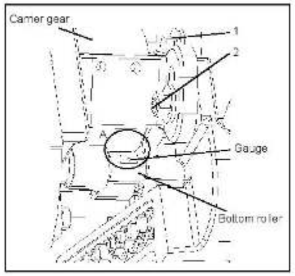
(3) Check the backlash between all bobbin drive wheels and bobbin gears. The backlash in the front row should be equal to that in the rear row.

(4) To adjust the backlash, move the drive shaft to the front or rear.

[5] Double-carrier gear meshing inspection



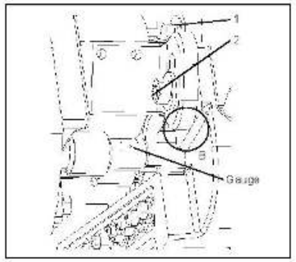
(1) Loosen double-carrier bracket set bolts (bolts **1** and **2**).



(2) Lift the carrier gear and insert the gauge (F8221-08010**) to the **A** portion (between bottom roller and gear).

NOTE: Carefully operate so as not to drop the gauge on the rear side.

(3) Gently lower the gear until it comes into contact with the gauge, and temporarily tighten bolts **1** and **2**.
Temporarily tighten while giving light tapping to the degree to allow the carrier gear to move.



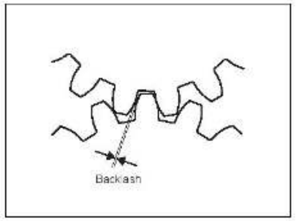
(4) While touching the gauge with one hand, lightly tap the **B** portion of the carrier bracket lightly toward the upper side.

NOTE: Never tap the gear portion.

(5) In succession to step (4) above, tighten bolts **1** and **2** in the position where the gauge can be moved lightly in the lateral direction.

(6) Remove the gauge toward the front while rotating it along the roller.

[6] Engagement of Change Wheels



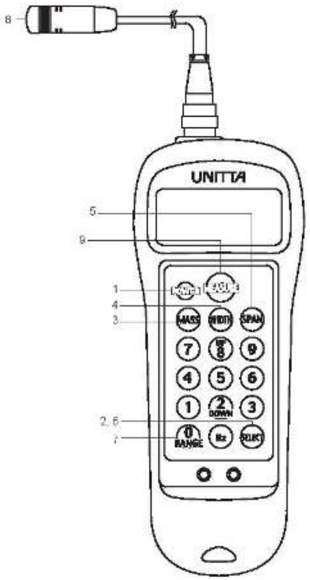
(1) Check the backlash of the following change wheels:

Check points	Backlash
1) Total draft change wheel (TDC)	0.2 to 0.3 mm
2) Back draft change wheel (BDC)	

(2) Check that the bolts of the change wheels are firmly tightened.

[7] Timing Belt Tension

(1) Inspection of belt tension using acoustic belt tension gauge
The instruction manual is attached to the acoustic belt tension gauge.
Carry out operation by referring to the instruction manual.



Operation Procedure

1. Turn on the power···Press [POWER].
2. Press [SELECT] to display any one of the Data Selection Screens from No.00 to No.19.
3. To input unit mass···
   - Manual input:
     For timing belt: Press [MASS] to input unit mass (g/mm × m).
4. To input belt width
   Press [WIDTH]
   For timing belt: Enter the value of the width (mm).
5. To input span length value···
   Press [SPAN] and check the value.
   - For values to be input for 3., 4. and 5., refer to the "Input Items to Belt Tension Gauge" on the next page.
6. Press [SELECT] and check the entries.
7. Setting frequency range···Keep pressing [0] for at least one second to display the Selection Screen (Back Screen 2.). Select one from "HIGH," "STANDARD," and "LOW" with either up 8. or down 2. button, and then set by pressing [MEASURE].
8. Bring the microphone close enough but not too close to touch.

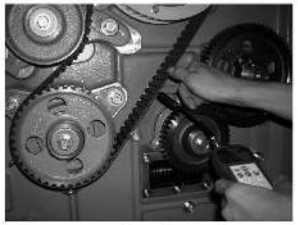


Image 1

9 Start measurement···Press [MEASURE] and flick the center of the belt span with your finger.

Figure of an electromagnetic sensor

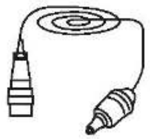


Fig. 1

* Accessory: Use of an optional electromagnetic sensor
Measurement may not be carried out with a standard specification microphone utilizing a flexible arm under high noise condition. In that case, remove it with the one-touch connector and replace with an attached electromagnetic sensor (Figure1).

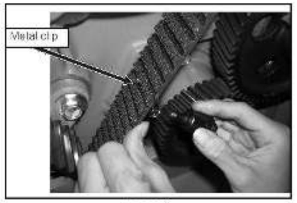


Image 2

When changing to the electromagnetic sensor, attach a metal clip to the center of the belt span.

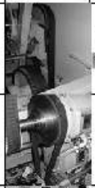
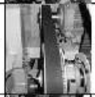
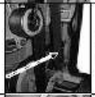
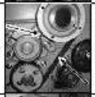
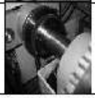
NOTE: Make sure to remove the clip when the measurement is complete.

10 The measured result (tension value "N") will be displayed in 1.5 seconds.

- Adjust the belt tension to the value within the range listed in the "Input Items to Belt Tension Gauge" on the next page.

11. Turn off the power···Keep pressing [POWER] for a while
("DATA SAVE" is displayed and the data is saved.)

<Input Items to Belt Tension Gauge (Each Block)>

Block	Tension measuring position	Belt part No.	Input item Unit mass (g/m × mm)	Belt width (mm)	Span length (mm)	Set tension
Drafting motor drive		72202-52005-00 (1520-6YU-40) Second roller drive	5.2	40	S = 495	350 to 500N
Winding motor drive		72202-68801-00 (1686-6YU-40)	5.2	40	S = 567	350 to 500N
Main motor drive		72202-54001-00 (1540-S14M-50)	9.0	50	S = 417	400 to 550N
Flyer drive		72202-00201-00 (2002-S14M-50)	9.0	50	S = 631	400 to 550N
Bobbin drive		72202-35802-00 (1358-HPS14M-50)	9.0	50	S = 354	400 to 550N
Flyer encoder drive		72202-46001-00 (460-5GT-9)	4.0	9	S = 104	40±10N (30N to 50N)

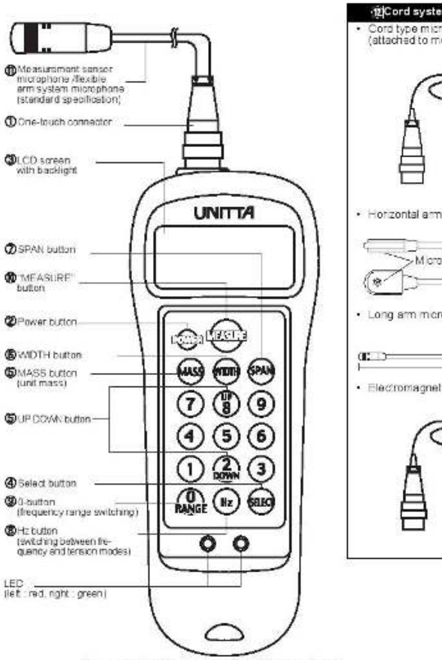
- When the value of tension measurement is out of the set tension range, adjust the tension with the tension bolt.
- Check whether the belt vibrates in trial running and contacts the surrounding parts.
  If the belt vibrates considerably, increase the tension within the set tension range.

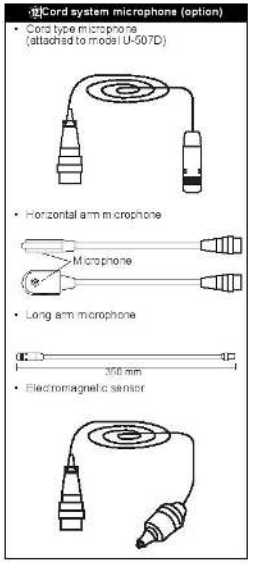
77135-00026-00 (U-507 sound-wave tensiometer by Unitta)

REFERENCE: Unitta U-507 acoustic tension gauge Instruction Manual (extract) (Option)

* The acoustic belt tension gauge is attached with an instruction manual.

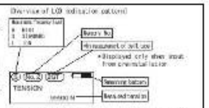
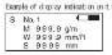
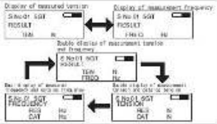
■ **Explanation of each part of U-507 Main part**


⑪Measurement sensor microphone /flexible arm system microphone (standard specification)
①One-touch connector
③LCD screen with backlight
⑦SPAN button
⑩"MEASURE" button
②Power button
⑧WIDTH button
⑥MASS button (unit mass)
⑤UP DOWN button
④Select button
⑨0-button (frequency range switching)
⑬Hz button (switching between frequency and tension modes)
LED (left : red, right : green)
UNITTA
POWER
MEASURE
MASS
WIDTH
SPAN
7
UP 8
9
4
5
6
1
2 DOWN
3
0 RANGE
Hz
SELECT

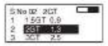

⑫Cord system microphone (option)
• Cord type microphone (attached to model U-507D)
• Horizontal arm microphone
Microphone
• Long arm microphone
350 mm
• Electromagnetic sensor

Power supply: Alkaline dry cells (AAA type × 2 pcs.)

①One-touch connector	Concave and convex connector has a slit mark and easily snaps into place when pushed in with such mark aligned. In disconnecting, hold the collar of connector on sensor side and pull, and it can be disconnected in one-touch simple operation.
②Power button	When "POWER" button is pressed, power is turned on. In turning off power, continue to press "POWER" button about one second. This instrument employs auto power-off function to turn off power in about five minutes from the last measurement, so if power is off during use, press "POWER" button again.

③LCD screen with backlight	- Displays tension value, etc. - Displays tension by three significant digits from 0.01 to 99900. - Displays frequency by three significant digits from 10.0 to 5000 Hz. - When the tension measurement result is out of the standard specification, LED (red) turns on and "ERROR" is displayed. * When tension exceeds its range after measurement result is displayed, the value for the last 2times are displayed, and retrial is prompted by "beep" sound. - Battery mark is displayed when battery is consumed. (When remaining voltage is low, the battery mark blinks, as well as "LOWBATT" blinks.) - Backlight is always on. However, it will turns off if it mot in use is not used for one minute, and will resume when operated again. Overview of LCD indication pattern  Example of display indication unit mass, belt width, span 
④Select button	- Press SELECT button to choose any desired input number displayed in power-on. 20 memory functions selectable from No. 0 to 19. * Call out numbers sequentially forward by pressing SELECT button, and press any number to jump to designated number. Here, when you call out No. 10 or larger, press the number continuously.
⑤MASS button (unit mass) UP DOWN button	- Belt type and unit mass are displayed when this button is held down one second or longer.Choose a desired belt type by use of "UP" and "DOWN" button, and determine by "MEASURE" button. (See page 9 for preinstalled unit mass.) * Display unit : g/m. S No 02 2GT 1 1.5GT 0.9 2 2GT 1.3 3 3GT 2.5 * CAT (rough standard), tension, and frequency are displayed only when belt type is chosen by MASS button.
⑥WIDTH button	- Choosing "WIDTH" button enables input of belt width with use of numeric key. Allowed input capacity: 000.1 - 999.9 mm/R * Enter the number of ribs for V belt.
⑦SPAN button	- Choosing "SPAN" button enables input of measurement span length with use of numeric key.
⑧Hz button (switching between frequency and tension modes)	- Pressing "Hz" button enables choosing between measurement tension display and measurement frequency display. * Display changes every time this button is pressed. - In addition, holding down Hz button enables dual display with tension and frequency. However, CAT display is available only when inputting from preinstalled data. (Displays only for timing belt.) * Displayed CAT value for tension and frequency are slightly different from standard installation tension of toothed belt on page11. Use them as a rough standard.  Display of measured tension Display of measurement frequency Double display of measurement tension and frequency RESULT TEN N FREQ Hz FREQUENCY TENSION RES CAT
⑨0 button (frequency range switching)	Hold down "0" button one second or longer to change measurement frequency range. HIGH .... 500 to 5000Hz STANDARD ...... 10 to 600Hz LOW .... 10 to 50Hz Choose a range with UP and DOWN button, and determine with "MEASURE" button. * In selecting 600Hz or above, the range must be switched to "HIGH range". Determine with "MEASURE" button. S No 01 HIGH STANDARD LOW
⑩"MEASURE" button	1. Press "MEASURE" button to set up auto trigger mode. * Initial display status is ├───┤ Measurement thereafter is started by receiving signals from the sensor. * Display ~~├ᴖ─ᴖ┤~~ sduring measurement. * After turning on power, allow an interval of 1 second or longer before pressing "MEASURE" button for automatic gain adjustment. 2. When the belt type is changed, press "MEASURE" button to start measurement. 3. When measurement frequency range is changed, press "MEASURE" button to start measurement in changed frequency range.
⑪Measurement flexible arm system microphone (standard specification)	The microphone itself has a small diameter of 12.5mm attaching flexible pipe system and can be positioned with single hand from the main body. It is useful for measurement in a place where the main body cannot be placed on floor such as a manufacturing site.
⑫Measurement sensor microphone (Option)	The following four types are available. **Cord system microphone (attached to U-507D)** The microphone has a small diameter of 12.5mm attaching cord system. It enables measurement in any use such as in congested places hard to measure. **Horizontal arm microphone** The microphone is as thick as 10mm and 20mm wide attaching flexible flat pipe system enabling measurement in the lateral direction. **Long arm micro-hone** The total length of the flexible arm system microphone in the standard specification is 350mm long and enables measurement of a belt in the inmost recess of the machine hard to be accessed by a tension gauge. **Electromagnetic sensor** The sensor reads to the vibration of a magnetic body, is not affected by ambient noises and enables measurement under such condition where vibration quickly attenuates. However, you need to attach a thin magnetic film or apply magnetic paint on the measuring surface.
⑬Transfer USB cable	The attached transfer USB cable connects the U-507 tension gauge with your PC to transfer measurement data.

■ Operation procedure of U-507

Procedu	Description	Operation	Display screen
1	Set up the microphone.	Choose an optimum microphone and fix in the main body with one-touch connector.	
2	Turn on power.	"POWER" button - PUSH	No.☐
3	Choose an input number with the select button and numeric key. Ex: Choose one from No. 0 to No. 2.	"SELECT" button - PUSH [Number is forwarded sequentially every time "SELECT" button is pressed. 0 →1→ →18→ 19 →0→ 1→ 2 In addition, you can jump to any designated number by pressing a number with numeric key.] ① Selecting procedure "SELECT" button - PUSH (1st time) "SELECT" button - PUSH (2nd time) ② Selecting procedure "2" button - PUSH * When "SELECT" button is pressed during the following procedure (during display of unit mass, belt width, span length input, and measured value), the number being chosen is displayed.	No.☐ No.0→No.1 No.1→No.2 No.0→No.2
4-1	When inputting a unit mass manually Ex: Input 2.5g/mm wide × meter long [See page 9 for input data.]	"MASS" button - PUSH [Input the unit mass (g/mm W × m L) in the order of blinking position on display screen by use of numeric key. If input is mistaken, press "MASS" button again to return the cursor to the first.] "0" button - PUSH "0" button - PUSH "2" button - PUSH "5" button - PUSH	M = ☐☐☐.☐g/m "Allowable input capacity 0.1 - 999.9 g/mm × m" M = 0☐☐.☐g/m M = 00☐.☐g/m M = 002.☐g/m M = 002.5g/m
4-2	When inputting the unit mass from belt type. Ex: Select 3GT.	"MASS" button, PUSH (holding down for one second or more) [Have belt types displayed on screen, and choose a belt type with "UP" button and "DOWN" button.] "DOWN" button - PUSH Place highlighted portion on 3GT. Press "MEASURE" button for selecting. 3GT is displayed on screen.	
5	Input the belt width. Ex: Input 25.4 mm [See page 8 for input data.]	"WIDTH" button - PUSH [Do the same as described above. When data above allowable capacity is input, the cursor returns to the first, and input of data is requested again.] "0" button - PUSH "2" button - PUSH "5" button - PUSH "4" button - PUSH	W = 0☐☐.☐mm/R "Allowable input capacity 000.1 - 999.9 mm" W = 0☐☐.☐mm/R W = 02☐.☐mm/R W = 025.☐mm/R W = 025.4mm/R
6	Input the span length. [See page 8 for input data.]	"SPAN" button - PUSH [Do the same as described above.]	S = ☐☐☐☐mm "Allowable input capacity 0001 - 9999 mm"
7	Start measurement.	① Bring the measurement microphone closer in the vicinity of span center of measurement target as far as it is out of contact with the belt (measurement target). ② "MEASURE" button - PUSH. LED (green) blinks and LCD displays |——| ③ Flip the belt span with a finger etc. to vibrate the wire. LCD displays |∿∿| The following measurement is performed by the microphone receiving sound without use of measure button for the 2nd time and on. Since measurement is started by the microphone receiving sound, measurement is started as well even by a noise if it has a relatively stable sound pressure. Result is displayed as well as peep sound emitted and LED (green) turns on in 1.5 sec after reception of belt vibration sound.	|∿∿| [In measurement for the 2nd time and after, previous data is displayed first. Inform the measurement data is renewed at the same time as peep sound.]
8-1	Displays tension.	Result is displayed as well as peep sound emitted and LED (green) turns on in 1.5 sec after reception of belt vibration sound. * When LED (red) turns on, see "checking item" in measurement malfunction on page 3.	T = 122N "Displays from 0.01 to 99900N in three significant digits"
8-2	Displays frequency. Displays frequency after measurement of tension.	"Hz" button - PUSH [Displays frequency corresponding to the measured tension. When "Hz" button is pressed once again, the display returns to tension mode.]	f = 235Hz "Displays from 10.0 to 5000 Hz in three significant digits"

■ Input procedure of data

1) Input of unit mass
[See table-1, table-2, and table-3.]

- Timing flat belt
  Input the mass per width (mm) × length (m) in "g/mm W × m L" for unit mass.
  Data of capacity can be input by four significant digits, i.e. three digits of integer and one digit below decimal point from 000.1 up to 999.9 g/mm W × m L.
- Timing V-belt
  (Input of belt unit mass from preinstalled data)
  When "MASS" button is held down (longer than one second), belt type is displayed on LCD. Scroll the display with UP button ("2") or DOWN button ("8") until the letter of desired belt type is highlighted. Then press "MEASURE" button for determining.
- V, V-ribbed belt and wire
  Input the mass per meter of length in "g/m length" for unit mass. Data of capacity can be input by four significant digits, i.e. three digits of integer and one digit below decimal point from 000.1 up to 999.9 g/m L. Unit mass corresponds to one piece for V-belt and wire, and one rib for V-ribbed belt.

	MASS	WIDTH	SPAN
Timing belt Flat belt	Unit weight g/mm W × mL	Belt width	Span length mm
V-ribbed belt	Unit weight per rib g/rib × mL	Number of ribs	Span length mm
V-belt	Unit weight g/belt × mL	1	Span length mm
Wire	Unit weight g/belt × mL	1	Span length mm

2) Input of belt width or the number of belts (ribs)

- Timing flat belt
  Data of belt width can be input by four significant digits, i.e. three digits of integer and one digit below decimal point in millimeters from 000.1 to 999.9 mm.
- V, V-ribbed belt and wire
  Input one (piece) of V-belt and wire.
  Input the number of ribs of V-ribbed belt.

3) Input of span length

- Span length is a distance between contacts with pulley, and can be calculated by the following equation accurately. Alternatively, measure the distance between pulley contacts with a measuring tape for facilitation.

$$S=\sqrt{C^2-\frac{(Dp-dp)^2}{4}}$$

where,

S:	Span length	(mm)
C:	Distance between axes	(mm)
Dp:	Large pulley pitch outer diameter	(mm)
dp:	Small pulley pitch outer diameter	(mm)

■ List of preinstalled belt type unit mass

Table-1: List of unit mass of toothed belt and V-belt

See the description of MASS button on page 5 and 6 for selecting. Input a value manually by use of unit mass list on the next page as for special pitch and special belt which are not described below.

Timing belt (Standard construction)							
Display	Unit mass	Display	Unit mass	Display	Unit mass	Display	Unit mass
MXL	1.2	3M	2.4	1.5GT	0.9	14MGT	8.0
XL	2.1	D3M	3.3	2GT	1.3	EV5GT	4.0
DXL	1.9	5M	3.8	3GT	2.5	EV8YU	5.1
L	3.1	D5M	4.2	D3GT	2.5	EV14M	8.7
DL	3.3	8M	6.1	5GT	4.0		
H	3.8	D8M	6.3	D5GT	4.3		
DH	4.4	14M	10.0	8YU	5.2		
XH	11.1	D14M	11.9	D8YU	5.4		
XXH	14.8	20M	12.8	8MGT	4.7		

(unit:g/mm width × m length)

V belt			
Display	Unit mass	Display	Unit mass
3VX	59.8	D (V)	534.6
5VX	165.6	E (V)	734.4
8VX	525.6	3VXPB	75.7
J (V)	6.6	5VXPB	210.8
K (V)	20.0	5MPF	10.5
L (V)	30.4	7MPF	25.7
A (V)	100.2	11MRF	52.1
B (V)	166		
C (V)	298.8		

unit mass: Mass per meter length of one rib(g/m length)

Display	Belt type
8MGT	Polychain GT2 8M
14MGT	Polychain GT2 14M

Display	Belt type
3VXPB	3VX Powerd band
5VXPB	5VX Powerd band

Display	Belt type
5MPF	Polyflex 5M
7MPF	Polyflex 7M

	Belt type
11MRF	Polyflex 11M

■ Unit mass list of timing belt made by Gates Unitta Asia

Table-2: Unit mass only for U-507/505 and U-305

Data of unit mass can be input by four significant digits, i.e. three digits of integer and one digit below decimal point in g/mm W × m L from 0.1 to 999.9 g/mm W × m L.

- List of timing belt unit mass specified as standard configuration

① Timing belt

Tooth type	MXL	XXL(50)	XL	DXL	L	DL	H	DH	XH	XXH
Pitch (mm)	2.032	3.175	5.080	5.080	9.525	9.525	12.700	12.700	22.225	31.750
Unit mass (g/mm width×m length)	1.2	1.6	2.1	1.9	3.1	3.3	3.8	4.4	11.1	14.8

② HTD belt

Tooth type	3M-HTD	D3M-HTD	5M-HTD	D5M-HTD	8M-HTD	D8M-HTD	EV14M	14M-HTD	D14M-HTD	20M-HTD
Pitch (mm)	3.000	3.000	5.000	5.000	8.000	8.000	14.000	14.000	14.000	14.000
Unit mass (g/mm width×m length)	2.4	3.3	3.8	4.2	6.1	6.3	8.7	10.0	11.9	12.8

③ GT belt

Tooth type	1.5GT	2GT	3GT	D3GT	5GT	D5GT	EV5GT	EV8YU	8YU	D8YU
Pitch (mm)	1.500	2.000	3.000	3.000	5.000	5.000	5.000	8.000	8.000	8.000
Unit mass (g/mm width×m length)	0.9	1.3	2.5	2.5	4.0	4.3	4.0	5.1	5.2	5.4

④ Polychain GT2 belt

Tooth type	8MGT	14MGT
Pitch (mm)	8.000	14.000
Unit mass (g/mm width×m length)	4.7	8.0

⑤ Carryflex timing belt

Tooth type	XL	L	H	T5	T10	C8YU
Pitch (mm)	5.080	9.525	12.700	5.000	10.000	8.000
Unit mass (g/mm width×m length)	1.2	2.5	3.4	1.5	3.6	5.2

⑥ Non standard pitch belt

Tooth type	101	102	103	104	111	109	181	25	8109
Pitch (mm)	1.5875	2.0320	2.1167	2.8222	1.4111	2.1167	2.8222	6.3500	10.4471
Unit mass (g/mm width×m length)	1.0	1.5	1.3	1.0	1.1	1.1	0.9	1.3	3.0

⑦ Urethane belt

Tooth type	UMXL	UXL
Pitch (mm)	2.032	5.080
Unit mass (g/mm width×m length)	0.9	1.6

■ Unit mass list of V-belt made by Gates

Table-3: Unit mass only for U-507

V-belt has a rather high rigidity, and difference is generated between the actual tension and measured value which requires correction in the range of standard installation tension. Therefore multiply the mass per meter length of one rib of belt by tension correction factor obtained by calibration by use of the formula below, and employ the resultant value as a WEIGHT value.

[M (g/m length) = Mass per meter length of one rib (g/m length) × Tension correction factor]

① Super HC type

Input item	3VX Single	3VX Power band	5VX Single	5VX Power band	8V Single
WEIGHT (Mass × compensation coefficient per 1 rib 1m length)	68.0×0.88 = 59.8	87.0×0.87 = 75.7	182.0×0.91 = 165.6	237.0×0.89 = 210.9	657.0×0.8 = 525.6

② Polyflex type

Input item	5M	7M	11M
WEIGHT (Mass × compensation coefficient per 1 rib 1m length)	11.0×0.95 = 10.5	27.0×0.95 = 25.7	56.0×0.93 = 52.1

③ Micro V type

Input item	J section	PK section	L section
WEIGHT (Mass × compensation coefficient per 1 rib 1m length)	9.0×0.95 = 8.6	21.0×0.95 = 20.0	32.0×0.95 = 30.4

④ Standard V type

Input item	A	B	C	D	E
WEIGHT (Mass × compensation coefficient per 1 rib 1m length)	120.0×0.86 = 103.2	200.0×0.83 = 166.0	360.0×0.83 = 298.8	660.0×0.81 = 534.6	1020.0×0.72 = 734.4

■ Overview, note, and checking item in defective measurement

■ Overview

The sonic belt tension meter (U-507) enables non-contact, simple, and accurate measurement of installation tension which is greatly related to belt function by analyzing sonic wave.
Sonic wave is generated by flipping the belt span with the belt standing still, and it is captured by the sensor and processed by high performance computer, and belt tension is displayed in digital mode.

■ Overview & checked item in measurement malfunction (when unsuccessful)

[Measurement mode is not established or data fluctuates significantly.]

Item	Phenomenon	Estimated cause (Assumed causes)	Checked item
"Error" is displayed or Measurement mode is not estabished, or LED (red) is on.	• Tension value doesn't come out dispite a few of trials. Otherwise, only "Measurement standby" is displayed after the 3rd time and on. (In case of frequency mode)	• "0" is entered to the entry parameters (unit mass, width, and span).	• Check the detail of entry item. (Enter an appropriate value to the item that "0" is input.)
		• Tension value has 6 digits or more.	• Tension is not measured although frequency is displayed.
		• Measurement frequency range is incorrect.	• Change of measurement frequency range (switching LOW and STANDARD, switching STANDARD and HIGH)
		• Measurement frequency exceeds 5000 Hz.	• Check whether measurement frequency is in excess of 5000 Hz or not.
		• Exhaustion of battery.	• Indication of battery life (When the battery display is as shown on the right:)
Output fluctuates greatly.	• The value changes greatly in every measurement.	• Microphone is in contact with the belt for a moment during measurement.	• Try measurement again at a appropriate distance where microphone is not in contact.
	• The value responds sensitively to the noise around (background noise) other than measured value.	• Automatic gain adjustment is insufficient.	• Turn off power once at a measurement place, and turn on again. (Turn on power with microphone installed, and press "MEASURE" button over one second later.)

3.1.2 Powering-on and Checking the Voltage Levels

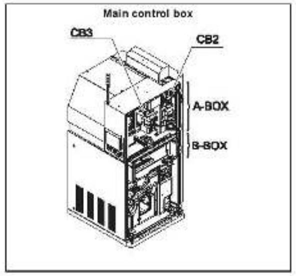
⚠ WARNING

Be sure to observe the rules given in Section S.1, Subsection S.1.4, "Rules for Operating or Checking the Electrical Devices."

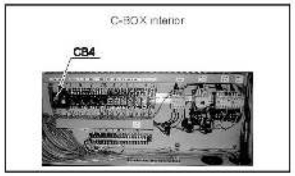
- Electrical devices should be handled only by persons with appropriate special qualifications (e.g., duly trained persons or electrical experts).
- The following work requires hot-line jobs when you check the plant power and control system power, so take extra care to keep your body away from the hot lines.
- Use the measuring devices and tools, all kept in proper condition.
- Even after the main circuit breaker is turned off, the inverter capacitor will remain charged for a while. Wait at least 20 minutes before accessing power lines directly.

Before proceeding to the voltage level checking below, be sure to complete the adjustment jobs given in Section 4.1.

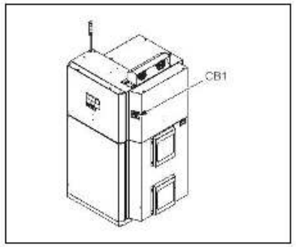
[1] Preparation



(1) Make sure that circuit breakers CB2 and CB3 located in the control box (A-BOX) are turned OFF.



(2) Make sure that circuit protector (CB4) located in the control box (C-BOX) is also turned OFF.



(3) Check that the primary voltage level of main circuit breaker CB1 on the FL is the specified level ±5%.

[2] Checking the Voltage Levels

(1) Use a tester to confirm that the primary side of CB1 is within ±5% of the factory's rated voltage.

(2) Open the control box and and turn ON breakers CB2 and CB3.

(3) Turn ON main breaker CB1.

(4) Confirm that the output voltage of three-phase transformer TF1 in the the control box (A-BOX) is 200V ±5%. (Terminal No. R4, S4, T4)

(5) Next, turn OFF the main breaker CB1.

(6) Turn ON breaker CB4 in the control box (C-BOX).

(7) Turn ON the main breaker CB1 again.

(8) Check that terminal block numbers 351 and 352 in the control box (C-BOX) have AC 100V.

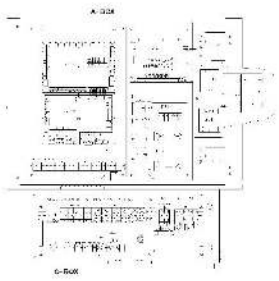
(9) Confirm the direct current voltage (the output terminal of electrical power board PCB2) of the control box (A-BOX).

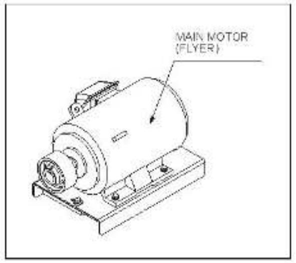
	Voltage	Terminal number
1	DC 5V	E5 ◀▶ P5
2	DC 12V	E12 ◀▶ P12
3	DC 24V	E24 ◀▶ P24
4	DC+15V	E15 ◀▶ P15
5	DC -15V	E15 ◀▶ N15

(10) Check the operation of the cooling fans.

1) Confirm that the gear head cooling fans (M5 to M6) are operating normally. Also confirm that the cooling fans (M14, M15) on the top of the control box are operating normally.
If the cooling fans are not operating, check if the door is closed and adjust the installation positions of the door safety switches (SWDR1 to SWDR4) again if necessary.

2) Confirm that the cooling fans (M12, M13) in the control box are operating normally.





3.1.3 Inspection & Adjustment During Test Run

⚠ WARNING

Observe the safety rules given in

Section S.1,S.1.2, "Rules for Safe Operation"

S.1.3, "Rules for Maintenance"

S.1.4, "Rules for Operating or Checking the Electrical Devices."

[1] Rotation Direction of Motors

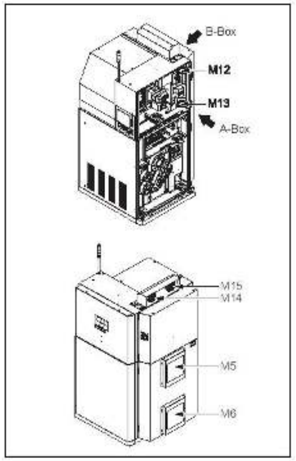
(1) Rotation direction of the main motor
This rotation direction of this motor has been confirmed at the time of shipment so that it will rotate in the direction listed below provided that the primary power cables have been connected correctly.

<Rotation Direction of Motors Viewed from Pulley Side>

Symbol	Motor	Rotation direction
M1	Main motor	↺

The main motor can be operated individually from the manual operation screen of the function panel. The rotation direction of the main motor can be also be seen here.

(See Section 5 for the individual motor operation method)



(2) The rotation direction of the cooling fan motors

Name	Symbol	Direction of air
Gear head cooling fan	M5	Sucks air into the head
	M6	Sucks air into the head
Control box internal fan	M12	From the B-Box to the A-BOX
	M13	From the B-Box to the A-BOX
Servo amp heat sink cooling fan	M14	Emitted outside the machine
Inverter heat sink cooling fan	M15	Emitted outside the machine

[2] Up-and Down-movement of Bobbin Rail by Handle Operation

(1) Power on the FL

(2) Press the Emergency Stop button.

(3) Open the front door (turn OFF the door safety switch).

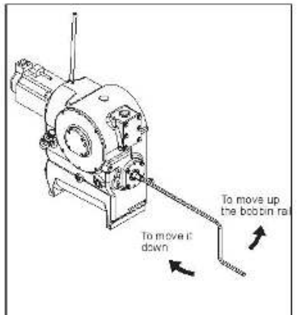
(4) Insert the handle into the lifting box and rotate it to move the bobbin rail up and down.

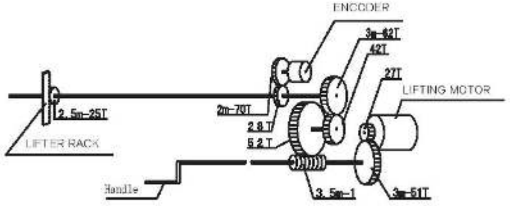
If you feel any abnormal resistance during the handle operation, immediately stop the operation and check to see that there is no foreign material around the bobbin rail, then continue your inspection by watching the machine carefully as you walk around it.

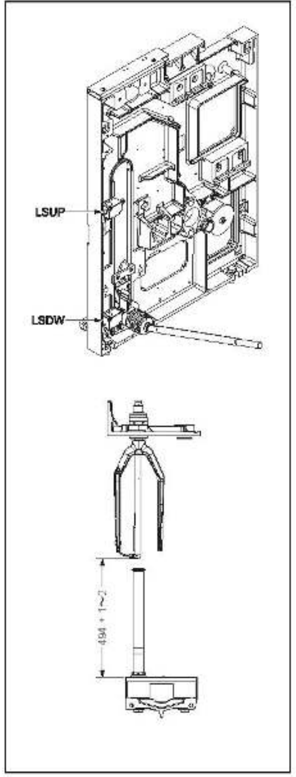
REFERENCE: Do not carry out handle operation with power OFF after setting the home position of the bobbin rail. Otherwise, running fails because the actual rail position will differ from that recognized by the machine. When powered on again, the following error message appears.

"E-28 Bobbin Rail Position Changed"

For the recovery operation from the error state, refer to Section 4.1, Subsection 4.1.6.


To move up
the bobbin rai
To move it
down


ENCODER
3m-62T
42T
27T
LIFTING MOTOR
2.5m-25T
2m-70T
28T
52T
LIFTER RACK
Handle
3.5m-1
3m-51T



[3] Safety Limit Switches for Bobbin Rail Overrun

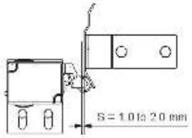
(1) Adjust the limit switch LSUP to operate when the bobbin rail moves up 1.5 to 2.5 mm above the switching point from up-movement to down-movement.

REFERENCE: In the test run, check that the LSUP does not operate during normal operation.

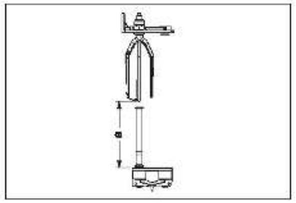
(2) Adjust the limit switch LSDW to operate when the bobbin rail moves down 1.0 to 2.0 mm below the lower position (where the distance from the end of the flyer spindle to the bottom of the bobbin is 494 mm).

REFERENCE: In the test run, check that the LSDW does not operate during normal operation.

(3) When these limit switches operate and release their actuators, make sure that there is clearance **"S"** as shown below.



[4] Home Position of Bobbin Rail



(1) Power off the FL.

(2) Adjust the height of the bobbin rail by using the handle so that the distance from the end of the flyer spindles to the bottom of the bobbins comes to "**a**" mm.

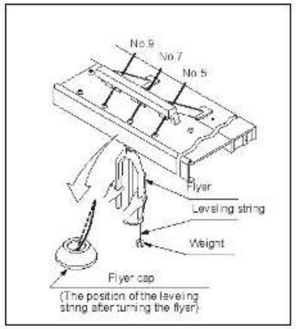
FL specifications	"**a**" (mm)
Equipped with FRD	496
Others	494

(3) Power on the FL.

(4) Insert the set key into the setting-enable (DATA SET) switch on the control panel and turn it clockwise to the ON position.

(5) The bobbin rail home position can be set from the function panel.
(Refer to Section 7. Operation Panel)
Only notify the system administrator of the password.

[5] Reference Position of Roving Tension Sensor


No.9
No.7
No.5
Flyer
Leveling string
Weight
Flyer cap
(The position of the leveling string after turning the flyer)

(1) As shown at left, pass a leveling string or a strong thin string* through the front roller and the outlet of the flyer pipe at each of spindle numbers 5, 7, and 9.
Hang a specified weight** to the string.
Secure the leveling string with the top and bottom rollers of the weighting arm.

*Thickness of leveling string: 0.5 to 1.0 mm

**Weight: 200 to 300 g

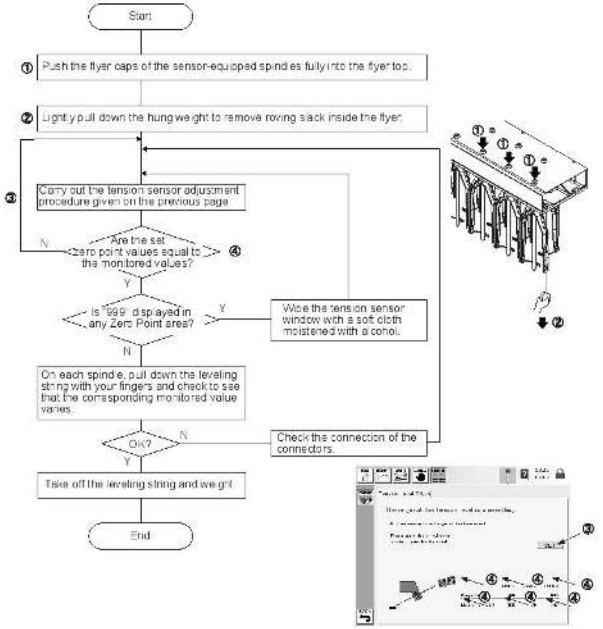
(2) Insert the set key into the setting-enable (DATA SET) switch and turn it clockwise to the ON position.

(3) The roving tension reference position can be set from the function panel.
(Refer to Section 7. Operation Panel)

NOTE: When setting the reference position turn the flyer clockwise approximately 10° to fix the leveling string in the position shown by the solid line in the diagram to the left.

■ Setting the Reference Position of the Roving Tension Sensor

Be sure to use new leveling string and weight.


Start
① Push the flyer caps of the sensor-equipped spindles fully into the flyer top.
② Lightly pull down the hung weight to remove roving slack inside the flyer.
③
Carry out the tension sensor adjustment procedure given on the previous page.
N
Are the set zero point values equal to the monitored values?
④
Y
Is "999" displayed in any Zero Point area?
Y
Wipe the tension sensor window with a soft cloth moistened with alcohol.
N
On each spindle, pull down the leveling string with your fingers and check to see that the corresponding monitored value varies.
OK?
N
Check the connection of the connectors.
Y
Take off the leveling string and weight.
End
①
①
①
②
③
④
④
④
④
④
④

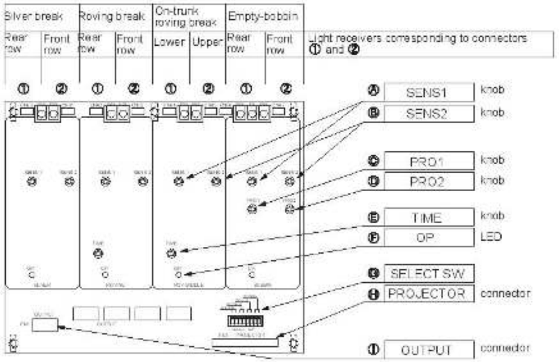
[6] Adjustment of Photoelectric Relay Unit's Switches for Stop Motion

(1) General description

The photoelectric switches of the photoelectric relay unit detect breakage of a roving or sliver when the roving or sliver interrupts the light beam between the light emitter and receiver each provided for detecting sliver break, roving break, on-trunk roving break, or empty-bobbin. The light source of each light emitter uses an infrared LED which issues pulsed beams to prevent them from getting affected by interference light, improving the S/N ratio.

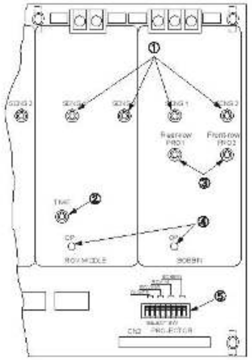
(2) Photoelectric switch control board

The photoelectric switch control board is functionally grouped into the following four:

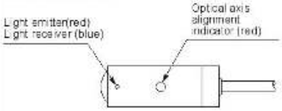

Sliver break
Roving break
On-trunk roving break
Empty-bobbin
Rear row
Front row
Rear row
Front row
Lower
Upper
Rear row
Front row
Light receivers corresponding to connectors ① and ②
① ② ① ② ① ② ① ②
Ⓐ SENS1 knob
Ⓑ SENS2 knob
Ⓒ PRO1 knob
Ⓓ PRO2 knob
Ⓔ TIME knob
Ⓕ OP LED
Ⓖ SELECT SW
Ⓗ PROJECTOR connector
Ⓘ OUTPUT connector

Ⓐ:Sensitivity control 1 knob	Adjusts the sensitivity for an object to be detected. Turning this knob clockwise increases the sensitivity, enabling detection of finer roving. Ⓐ for connector ①, Ⓑ for connector ②.
Ⓑ:Sensitivity control 2 knob	
Ⓒ:Light intensity control 1 knob	Adjusts the intensity of light to be emitted for preventing malfunction due to reflection from the rear-row bobbins.
Ⓓ:Light intensity control 2 knob	Adjusts the intensity of light to be emitted for preventing malfunction due to reflection from the front-row bobbins
Ⓔ:Malfunction prevention control knob.	Prevents malfunction due to dust, fly or fleece
Ⓕ:Operation indicator LED	Comes on at the time of output
Ⓖ:Selection switch	Allows you to activate or deactivate each of the photoelectric switches.
Ⓗ:Light emitter connector	Connects the hook-up wires of the light emitters located at the OE.
Ⓘ:Connector	Supplies power (12 VDC ±5%) and outputs signals.

Photoelectric switch control board


①
SENS 2
SENS
SENS
SENS 1
SENS 2
Rear row PRO 1
Front row PRO 2
③
TIME
②
④
OP
OP
ROV.MIDDLE
BOBBIN
⑤
SELECT SW
CN2 PROJECTOR

Photoelectric switch


Light emitter(red)
Light receiver (blue)
Optical axis
alignment
indicator (red)

(3) Optical axis adjustment of photoelectric switches

Each of the photoelectric switches uses an infrared LED whose optical axis cannot be checked visually, To adjust the optical axis so that the switch operates correctly and stably, you need to carry out the following procedure.

1) Photoelectric switches for detection of roving breaks sliver breaks and on-trunk roving breaks

a. Set the sensitivity control ① knob to division 2.

b. Set the malfunction prevention control knob ② to division 2.

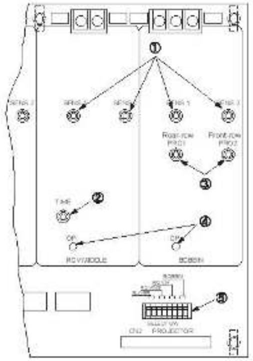
c. Install the photoelectric switch so that its light emitter and receiver face each other.

Then adjust the position of the emitter's and receiver's brackets by using the three adjuster screws so that the optical axis alignment indicators (red) on the light emitter and receiver come on.

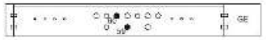
Operation indicator	Optical axis
OFF	Not aligned
ON	Aligned

REFERENCE: When setting up the above beam axes in the final adjustment, take into account the frequency of roving breaks and on-trunk roving breaks and fly/fleece.

Photoelectric switch control board



For 120-spindle frames



2) Photoelectric switches for detection of empty bobbins

a Set the sensitivity control ① knob to division 2.

b Install the photoelectric switch so that its light emitter and receiver face each other

c Check that there is no obstacle in the optical axis of the photoelectric switch and that operation indicator LED ④ is off.

Adjust the optical axis for rear-row bobbins with the steps below

d Put a single bobbin at the center of the frame (No. 60 in the case of 120-spindle frame) and check whether operation indicator LED ④ comes on.

- If the LED comes on, the detection is normal.
- If the LED does not come on or it takes 10 seconds or more until the LED ④ comes on, go to step e

e Turn light intensity control 1 knob [PRO1] ③ counterclockwise until the LED ④ comes on

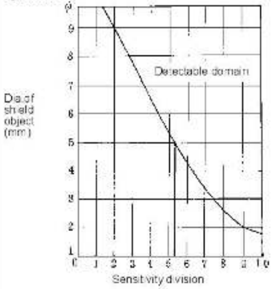
f Repeat steps c and d above to check that the detection is normal.

Adjust the optical axis for front-row bobbins in the same way as above except for the following:

- Put a single bobbin at the center of the frame (No. 59 in the case of 120-spindle frame)
- Turn light intensity control 2 knob [PRO2] ③.

REFERENCE: Selection switch ⑤ allows you to deactivate each of the photoelectric switches by turning the selector off

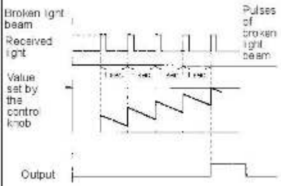
Relationship between the dia. of shield object and graduation



(4) Adjustment of sensitivity
After completion of the optical axis alignment, set the sensitivity control knob to the division suited to the diameter of the shield object.

The graph given at left shows the relationship between the diameter of the shield object and the graduation. If the diameter of the shield object is 5 mm, for example, set the sensitivity control knob to division "5 to 6." Then practically interrupt the optical axis with an actual shield object several times and adjust the sensitivity control knob to the minimum division where no detection miss occurs.

Setting the sensitivity control knob to higher division than required will not improve the detecting effect.



NOTE: If the light beam is broken approx. five times at 1-second or less intervals, the malfunction prevention control will be activated.

(5) Adjustment of malfunction prevention control (only for roving breaks and ontrunk roving breaks)

This adjustment should be made after completion of the sensitivity adjustment. If the malfunction prevention control knob is fully turned counterclockwise, the malfunction prevention control works even when the optical axis is interrupted once. The more you turn the knob clockwise, the greater becomes the interrupt times of the optical axis required for activating the malfunction prevention control. Adjust the malfunction prevention control knob taking into account the frequency of roving breaks and ontrunk roving breaks and fly/fleece.

The timing scheme given at left shows the operation of the malfunction prevention control when the knob is fully turned clockwise.

NOTE: When setting the number of interrupt times of the optical axis, use shield objects with the diameter of ø5 or less for preventing setting miss.

(6) Maintenance and inspection

1) Periodically clean the lens surface of the light emitter and receiver to remove dust, dirt, or oil.

2) Over extended periods of use, the optical axis of light emitters and receivers may become off alignment due to vibration. In such a case, adjust the position of the emitter's and receiver's brackets by using the three adjuster screws so that the optical axis alignment indicators (red) on the light emitter and receiver come on.

3) If any of the photoelectric switches does not function normally, check that:

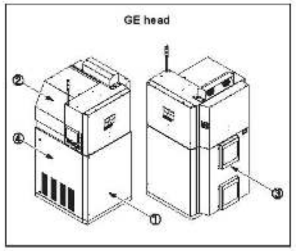
a. The line voltage is within the specification.

b. No wrong wiring is made.

c. The optical axes are correctly aligned.

d. The sensitivity control knobs are set to the proper division.

e. The lens surfaces of the light emitters and receivers are not stained.


GE head

[7] Safety Circuitry

⚠ CAUTION

Be sure to observe the rules given in Section S.1, Subsection S.1.2, "Rules for Safe Operation."

- The following job should be carried out by two workers.
- Never start the FL without communicating your intention to co-workers or without confirming their answer to your signal.
- Never reach out towards the rotating or operating parts until the FL comes to a complete stop.

(1) Press the Emergency Stop button when the FL is in operation and check to see that the machine immediately stops.

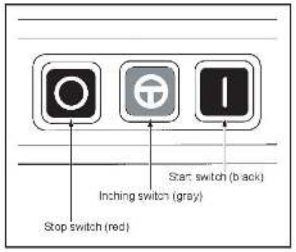
(2) When the FL is on halt due to the Emergency Stop button pressed, press the Start switch and check to see that the FL will not run.

(3) Open each of the following doors when the FL is in operation and check to see that the FL stops:

① Main door
② Draft gearing cover
③ Rear door
④ Front door

(4) When any of the above doors is opened, press the Start switch and check to see that the FL will not run because of the door safety switch.

[8] Functions of Start, Stop, and Inching Switches

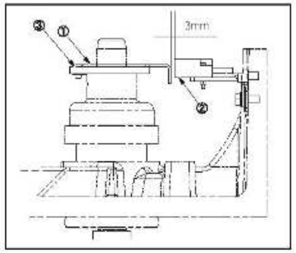


⚠ CAUTION

> Be sure to observe the rules given in Section S.1, Subsection S.1.2. "Rules for Safe Operation."
>
> - Never start the FL without communicating your intention to co-workers or without confirming their answer to your signal.
> - Never reach out towards the rotating or operating parts until the FL comes to a complete stop.

Press each of the Start, Stop, and Inching switches provided on the front side of the flyer rail cover to check each function.

[9] Flyer Stop Position Sensor (PRS1)



Adjust the flyer stop position for easier full-bobbin doffing jobs.

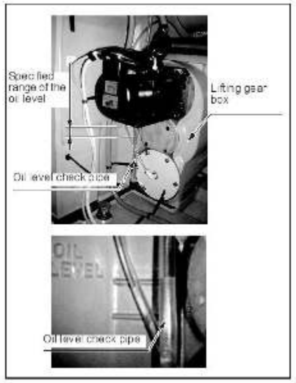
(1) Set dog ① on the 6th flyer gear.

(2) Provide a 3-mm gap between sensor ② and dog ①.

(3) Adjust the mounting angle of dog ①, then secure it with setscrew ⑤.

REFERENCE: Stop at the position desired by the customer.

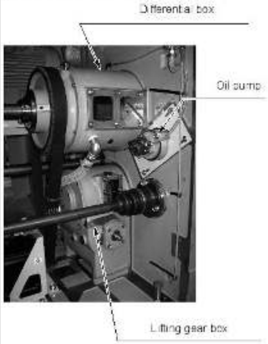
[10] Lubrication Oil Level


Specified range of the oil level
Lifting gear box
Oil level check pipe
OIL LEVEL
Oil level check pipe

(1) Confirm that the oil level in the oil tank is within the specified range using the oil level check pipe that comes out of the lifting gear box and the oil level indicators on the rear surface.

(2) Check that no oil pipes are in contact with any rotating sections and that none are bent.

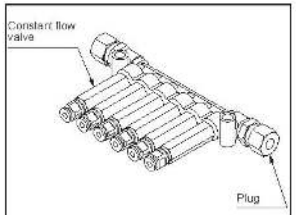
NOTE: When adding or changing oil, use the specified oil only by referring to Section M.1.

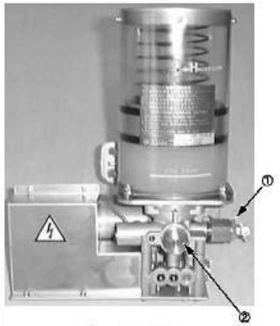

Differential box
Oil pump
Lifting gear box

[11] Oil Circulation inside the GE Head

(1) Make sure that the oil pump normally feeds oil from the oil tank to differential box through the transparent pipe.

(2) Confirm that oil is fully lubricating the lifting gear box.





① : Grease nipple

② : Air vent valve

[12] Operation of Centralized Lubrication System (option)

(1) Refilling grease
Refill grease through grease nipple ①.

- Take care not to let air or dust enter grease.
- Never use grease other than the specified type.

Never mix different brands of grease.

(2) Discharging grease

1) Letting air out of the main pipe

a. Remove the plugs from the OE of the main pipe and then remove the pressure switch from the draft gearing.

b. Press the lubrication switch "ON" on the Maintenance Monitor screen of the operation panel to run the pump. (Refer to Section 5.1. Subsection 5.1.4 [2].)

c. Wait for grease coming out from those cocks.

d. Press the manual switch again to stop the pump, and install the removed plug and pressure switch.

2) Checking the discharge of grease

a. To let air out of the branch pipes extending from the constant flow valves to the lubrication points, press the lubrication switch "ON" on the operation panel.

b. Press the lubrication switch "OFF" to stop the pump.

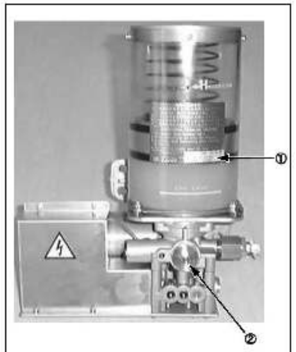
c. Open the end plug to release the pressure (for 5 to 10 seconds).

d. Close the end plug after releasing the pressure.

e. Repeat steps a. through d. above.

f. Check that grease comes out of all lubrication points.

g. After the end of air bleeding, install the plug and pressure switch.



① : Follow Plate
② : Air vent valve

(3) Precautions when using the lubrication system

1) If follow plate ① inside the tank comes down to the LOW level, be sure to refill the tank with grease.

REFERENCE: If air bubbles become entrapped in grease during refiling so that no grease comes out from the pump, rotate the screw of air vent valve ② counterclockwise by one turn and then run the pump repeatedly until grease comes out.

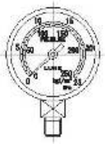
2) Use the specified grease only. Do not use other types.

3) When refilling with grease, use the dedicated grease gun and refill through the grease nipple.

REFERENCE: Do not refill grease from the top of the tank by removing the follow plate. Refilling from the top of the tank will cause air bubbles or foreign material to enter grease, resulting in a lubrication failure.

4) Check the sections where the flexible hoses are used, for no grease leak.

5) Check that the branch pipes are correctly extended to the lubrication points from time to time.



(4) Reference values for the pressure gauge

1) During ordinary discharging:
The gauge's pointer fluctuates within the range from 0 to 0.98 MPa (0 to 10 kgf/cm^2)

2) During discharging through constant-flow valves:
The gauge's pointer quickly moves from 1.96 MPa (20 kgf/cm^2) and then fluctuates within the range from 7.84 to 11.76 MPa (80 to 120 kgf/cm^2).

3) After the pump stops:
The gauge depressurizes itself and returns its pointer to 0 MPa (0 kgf/cm^2). (It will take approx. 2 to 3 hours which depend upon the ambient temperature.)

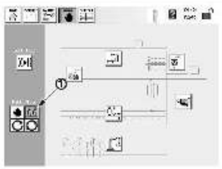
REFERENCE: Since the pressure gauge is not installed in the piping route, connect it after removing the plug for the flyer or the pressure switch for the bobbin.

[13] Smooth Movement of Bobbin Rail

(1) Press the Bobbin rail-up and rail-down switches and check to see that the bobbin rail moves up and down smoothly.

(2) If the rail movement is not smooth, adjust the gap between the lifter slide and the piece slide.

(3) Check that the lifter slide is lubricated.



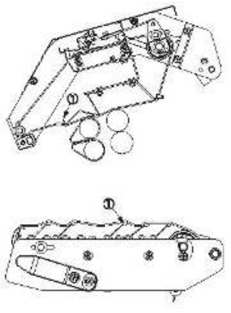
[14] Automatic Lowering of Bobbin Rail

(1) Select the doffing mode selection switch ① on the function panel as shown in the diagram to the left.

(2) Set the temporary full-bobbin length. For the setting procedure, refer to Section 5.

(3) Run the FL and check that the bobbin rail automatically comes down at the time of full bobbin.

Cloth Pressers for the Top Clearers



[15] Operation of Top and Bottom Clearers

(1) Check that the clearer clothes on the top and bottom clearers move smoothly and intermittently.

If any problem is noted, adjust the inclination of the comb bar.

(2) Check that the cloth pressers ① are correctly positioned so that the clearer clothes are in good contact with the rollers.

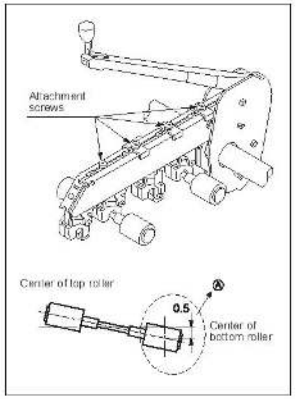
If any problem is noted, adjust the cloth pressers.

(3) Check that the comb bar periodically removes fly or fleece waste accumulated on the clearer clothes.

If any problem is noted, adjust the inclination of the comb bar.

For the adjustment of the top and bottom clearers, refer to Section M.1, Subsection M.3.4.

[16] Parallelism of Weighting Arms


Attachment screws
Center of top roller
Ⓐ
0.5
Center of bottom roller

(1) Visually check from the top of the top roller that the distance **"A"** with relative to the center of the bottom roller is within 0.5 mm on each of the weighting arms.

(2) If the distance **"A"** is out of the specification, adjust the elements by loosening the element mounting screws.

Section 4.1
Operation

4.1.1 Precautions 4.1-2

4.1.2 Basic Operating Procedure 4.1-3
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  - [2] Starting the FL 4.1-4
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  - [6] Choosing the Doffing Type with the Doffing Selection Switch 4.1-9
  - [7] Operating Procedures to be Taken with Special Care 4.1-10

4.1.3 Manual and Automatic Doffing Sequences 4.1-12
  - [1] Manual Doffing Sequence 4.1-12
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  - [3] How to Doff and Load Bobbins By Hand 4.1-14

4.1.4 Setting the Operation Conditions 4.1-15
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  - [2] Bobbin Configuration 4.1-15
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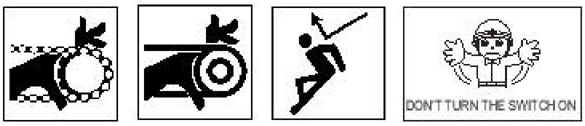
4.1.5 Operation of the Bobbin Rail Up/Down Handle 4.1-18

4.1.6 Changing the Set Data 4.1-19
  - [1] Set Data not to be Modified Halfway Through Roving 4.1-19
  - [2] When to Change the Set Data 4.1-19

4.1 Operation

4.1.1 Precautions


DON'T TURN THE SWITCH ON

⚠ WARNING

Observe the safety rules given in Section S.1, "SAFE WORK" and S.1.2 "Rules for Safe Operation."

(1) Absolute precautions

1) Never start the FL without communicating your intention to co-workers or without confirming their answer to your signal.

2) Never touch rotating or operating parts until all units of the FL come to a complete stop.
In the automatic doffing operation, be careful even if those moving parts seem to have stopped. The FL may stop temporarily and will start operation automatically and suddenly.

3) Never operate the FL in clothes which could become entangled in the rotating parts.

4) Never remove any of the warning notice, caution plates or instruction plates from the FL, no matter what.

5) The temporary warning notice (tag) should be removed only by the person who put it up, once it has become unnecessary.

(2) Handling abnormal situations

1) Always power off the FL before making any adjustments or repairs to correct abnormalities occurring during operation.

2) If you turn off the FL, be sure to put up the warning notice on the power switch.

3) The temporary warning notice (tag) should be removed only by the person who put it up, once it has become unnecessary.

(3) Other precautions

1) The supervisor should make sure that each worker sufficiently observes all safety rules.

2) Observe the safety codes and regulations enforced in individual countries.

3) When removing fly, fleece or fiber dust, use a picker or take-up rod. Never do it directly by hand.

4.1.2 Basic Operating Procedure

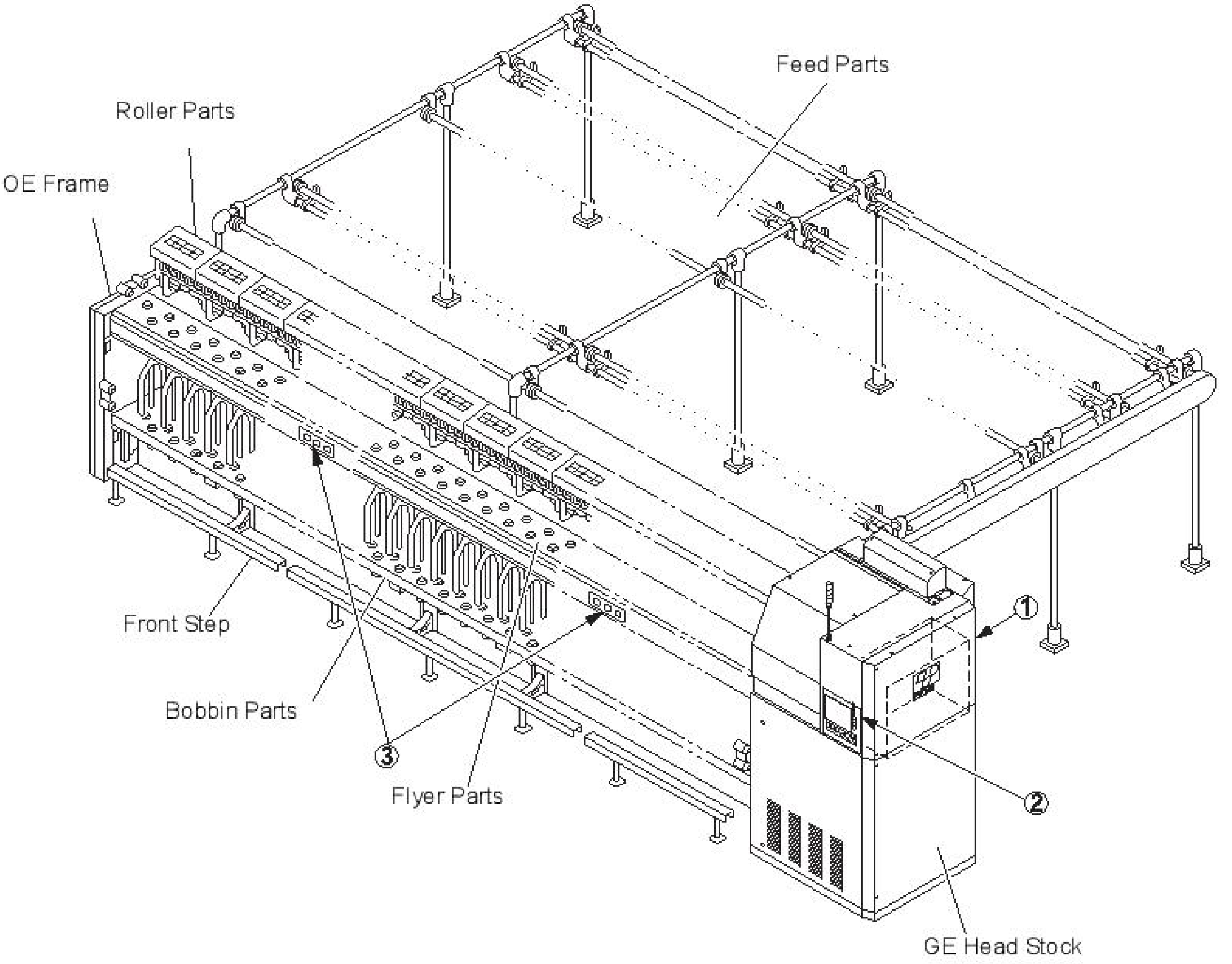
You may operate the FL by using the following push-button switches and the operation panel:

① Main Power switch CB1 (on the control box)

② Operation Panel (bobbin rail raising and lowering buttons, data set key switch, emergency stop button, function panel)

③ Bobbin Rail-up and -down switches and Emergency Stop button (on the operation panel)

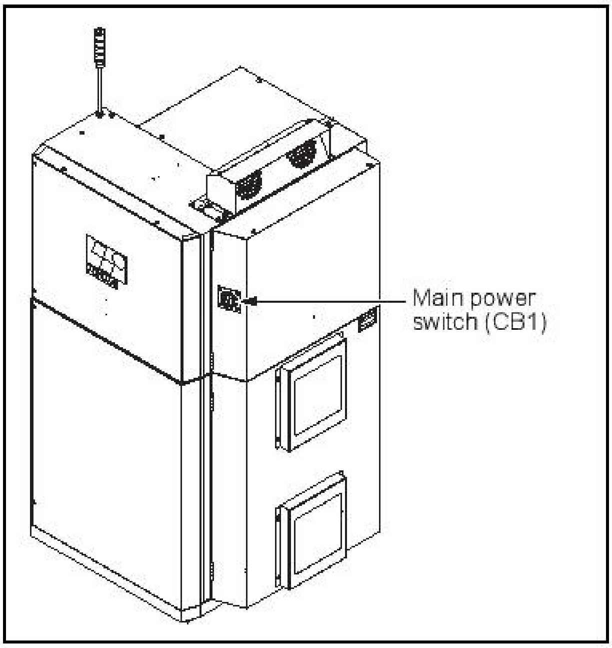
[1] Location of Push-button Switches and Operation Panel


Feed Parts
Roller Parts
OE Frame
①
Front Step
Bobbin Parts
③
Flyer Parts
②
GE Head Stock

[2] Starting the FL

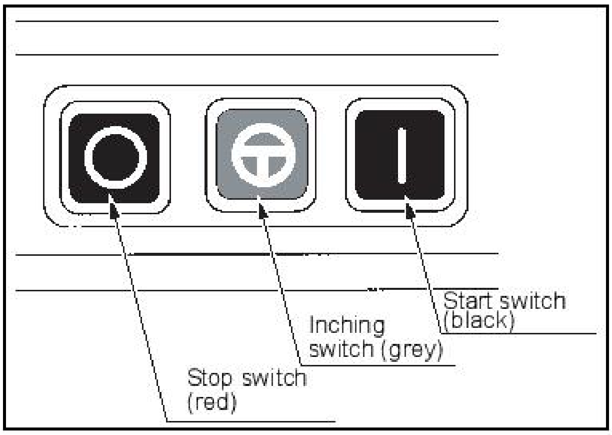
⚠ WARNING

- Never start the motor without communicating your intention to co-workers or without confirming their answer to your signal.
- Never reach out towards the rotating or operating parts until the FL comes to a complete stop.



(1) Turn the Main Power switch (CB1) on.

- The FL cannot operate for approx. 20 to 30 seconds after powered on, since the integrated computer requires the set-up time.
- If the monitor screen appears on the function panel then you may operate the FL.



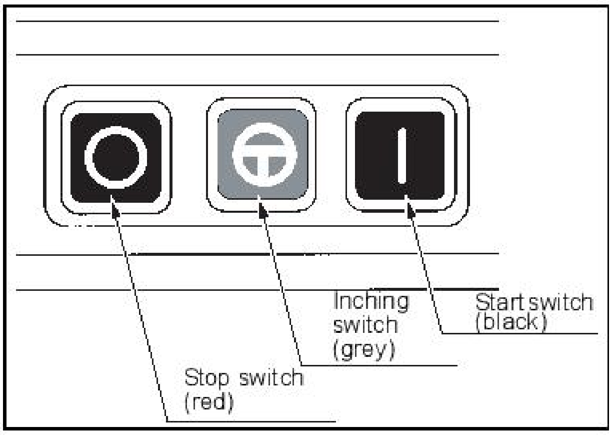
(2) To run the FL, press the Start switch (black).

(3) To inch the FL, press the Inching switch (grey).

- Only while the Inching switch is held down, the FL will inch.
- Decrease the number of pressing times of the Inching switch as much as possible.

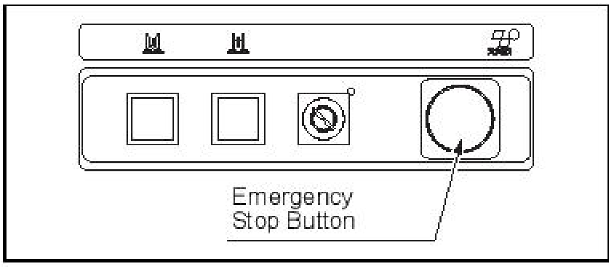
[3] Stopping the FL

NOTE: If you stop the FL by pressing the Stop switch or Emergency Stop button, the shoulder-stop avoiding function will not work.



(1) To stop the FL while it is in normal operation, press the Stop switch (red).

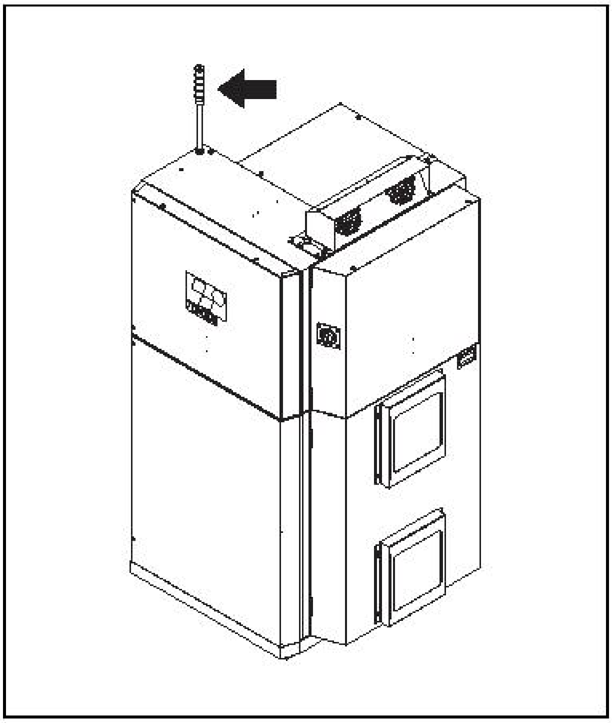
REFERENCE: When the Stop switch has been pressed the shoulder-stop avoidance function will not operate. Therefore, please press the Stop switch so that the stop position will not be near the shoulder of the roving shape.



(2) To stop the FL in an emergency, press the Emergency Stop button. If pressed, the button will be locked.

- Pressing the Emergency Stop button immediately stops all of the FL operations. Then, the "EMERGENCY STOP" message will be displayed on the function panel.
- To restart the FL, turn the Emergency Stop button clockwise to release the lock. Then touch the Reset Switch on the function panel to remove the error message. After that press the Start switch.

NOTE: Pressing the Emergency Stop button does not activate the shoulder-stop avoiding function.



[4] Signal Indicator

The signal indicator gives you instant knowledge of the current machine status of the FL.
Unlike the operation panel, it is located on the GE as shown at left so that operators can check the current machine status comparatively far from the FL.

[4.1] Signal indicator states and machine status

Lamp state / Lamp color	Lit	Flashing
Red	Ordinary stop	Abnormal stop
Green	Sliver break	Sliver change
Yellow	Roving break	On-bobbin roving break
White	Full-bobbin	Bobbin rail reached the bobbin loading position

NOTE: The signal indicator specifications may differ depending upon the customer needs.

NOTE: The machine states and corresponding signal indicators can be changed by using the function panel. (Refer to Section 5. 5.1.10 [3])

[4.2] Error recovery procedures (in the case of the default setting)

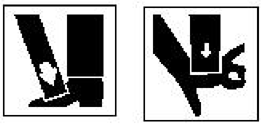
(1) If the green lamp comes on or the yellow lamp comes on or starts flickering:
It means that the stop motion operates due to an occurrence of a sliver break, roving break, or on-trunk roving break.
→ Tie the broken rovings together and press the Stop switch (red) to stop the lit or flickering state of the signal indicator. Then, start the FL again. (This error can also be cancelled by using the error message reset switch.)

(2) If the green lamp starts flickering:
It means that the cans have run out of sliver.
→ Replace the empty cans with full cans. Press the reset switch to cancel the error message and flickering green lamp. Then restart the machine.

(3) If the red lamp starts flickering:
It means that the FL has come to an abnormal stop.
→ Check the error messages displayed on the function panel to learn the source of the error. After fixing the error, touch the Reset Switch to cancel the error message and the flickering state of the red signal lamp. Then, start the FL again.

(4) If the white lamp starts flickering:
It means that the bobbin rail has reached the bobbin loading position.
→ Load bobbins and press the Bobbin Rail-up switch. If the bobbin rail moves up to the winding start position, the white lamp will go off.

[5] Moving Up and Down the Bobbin Rail

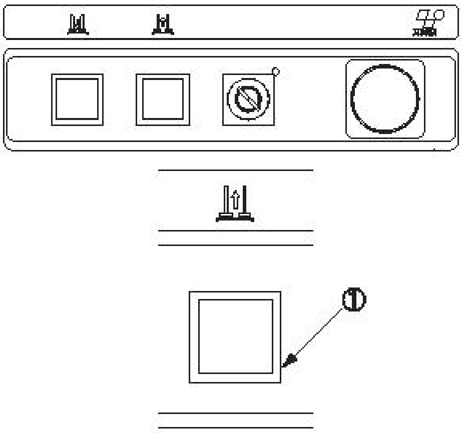


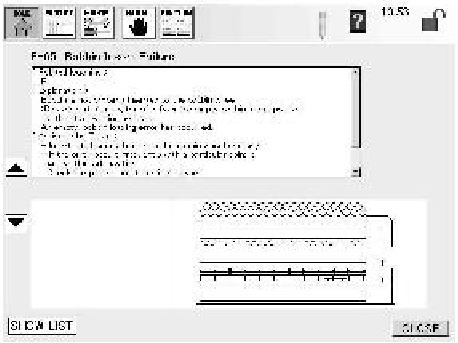
⚠ WARNING

NEVER reach out towards the bobbin rail or let a part of your body get on or under the bobbin rail when the bobbin rail is in upward or downward motion.

Pressing the Bobbin Rail-up and -down switches on the operation panel moves up and down the bobbin rail, respectively.

[5.1] Moving up the bobbin rail





E-65 Bobbin Insert Failure

(1) For manual doffing (standard specification)

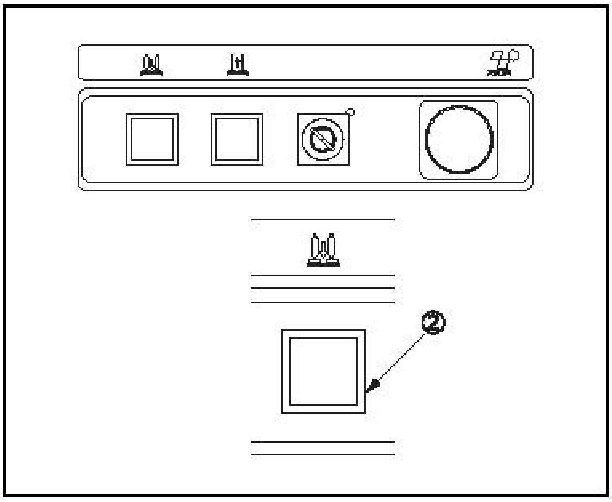
1) Press the Bobbin Rail-up switch ① when the bobbin rail is in the doffing position. The bobbin rail will move up to the bobbin loading position (where bobbins should be loaded).
(If you mistakenly load bobbins in the doffing position, the bobbin rail will not move up and the error message “E-65 Bobbin Insert Failure” will appear. In such a case, remove the bobbins, press the "Reset Switch" to clear the error message, and then press the Bobbin Rail-up switch ①.

2) If the bobbin rail reaches the bobbin loading position, the white lamp starts flickering. Check the white lamp flickering, then load bobbins and press the Bobbin Rail-up switch ① again. The bobbin rail will move up to the winding start position. If it reaches the winding start position, the while lamp will go off.

(2) For automatic doffing (with FRD)

1) In the doffing position, automatic doffing operation takes place and then the following operations follow automatically:
“Bobbin rail up-movement to the 1st moved-up position” or “Bobbin rail up-movement to the empty-bobbin loading position” → “Bobbin tilt detection” → “Bobbin rail up-movement to the winding start position” → “Restart”

2) If loaded bobbins are tilted, the “Bobbin tilt detection” works so as to show the error message “E-65 Bobbin Insert Failure.”
To recover from the error state, correct the tilted bobbins, press the "Reset Switch" to clear the error message, and then press the Bobbin Rail-up switch ①. The bobbin rail will move up to the winding start position.



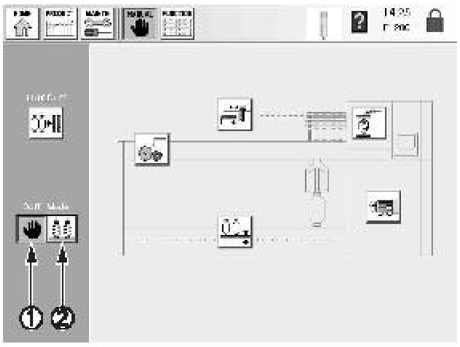
[5.2] Moving down the bobbin rail

Pressing the bobbin rail-down switch ② moves the bobbin rail down to the doffing position.

REFERENCE: For the detailed sequence of the bobbin rail movement triggered by the Bobbin Rail-up and -down switches, refer to Subsection 4.1.3 [1].

[6] Choosing the Doffing Type with the Doffing Selection Switch

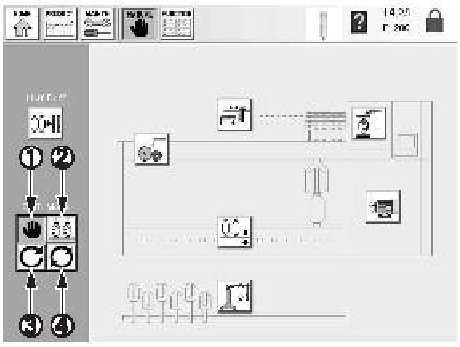
[6.1] If the FL200 is not equipped with an automatic doffer (FRD):



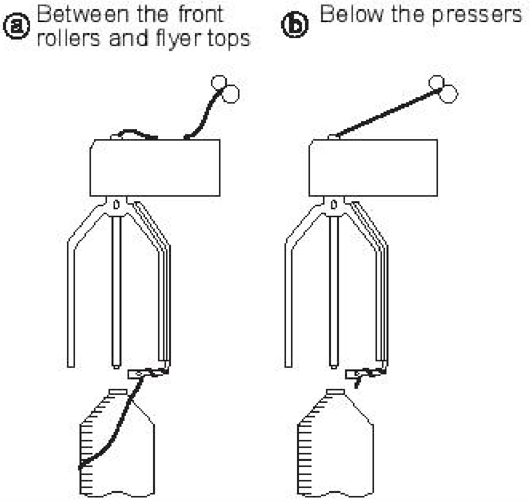
Set the doffing selection switch on the manual operation screen to position ✋ ① or ②.

- When the doffing selection switch is set at position ✋ ①:
  To move the bobbin rail up or down, press the bobbin rail-up or -down switch, respectively.
- When the doffing selection switch is set at position ②:
  The bobbin rail will move down automatically. To move it up, press the bobbin rail-up switch.

[6.2] If the FL200 is equipped with an automatic doffer (FRD):



Roving Breaking Position at Doffing



Usually set the doffing selection switch to the automatic doffing position ↻ ③ or ⟳ ④.

- When the doffing selection switch is set at position ↻ ③:
  After completion of doffing, the machine stops at the FRD empty bobbin loading position. The bobbin rail rises to the winding start position when the bobbin rail-up switch is pressed.

  NOTE: Before pressing the Start button, be sure to make sure that empty-bobbins are set in place.
- When the doffing selection switch is set at position ⟳ ④:

⚠ WARNING

If the doffing selection switch is set at position ④, the FL200 will automatically restart after completion of automatic doffing. Be sure to keep away from the FL200 and doffer even they seem to be stationary.

The FL200 will automatically carry out doffing and restart, enabling fully-automatic continuous operation.

NOTE: Depending upon the sliver type (material), number of twists, roving thickness, and number of windings on the pressers, roving may be broken between the front rollers and flyer tops when the bobbin rail moves down for doffing.
If such a problem happens, set the doffing selection switch to position ✋ ① and carry out doffing manually. When the FL200 comes to a full-bobbin stop, cut off roving by hand.

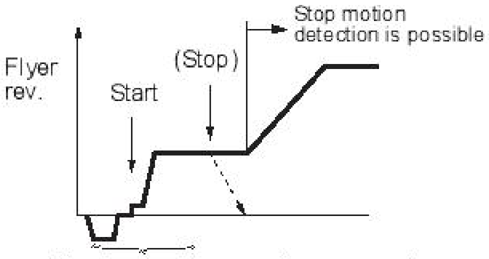
[7] Operating Procedures to be Taken with Special Care

[7.1] Restarting after Doffing

In order to restart the FL 200 smoothly after completion of the doffing, you should press the Start switch (automatic winding start) and not the Inching switch. This is because starting with the Start switch makes it easier for the pressers to press roving against the bobbin surfaces, facilitating the automatic winding.
(See the diagrams below.)

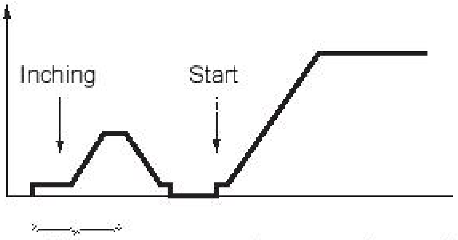
However, if the automatic winding does not proceed smoothly, immediately press the Stop switch to prevent the spindles from producing short-wound cops. The stop motion will not work during the automatic winding operation.

Starting with Start Switch (automatic winding)



The pressers can easily press roving.

Starting with Inching Switch



The pressers cannot press roving easily.

[7.2] Tension Sensor

The FL is equipped with a tension sensor for detecting and controlling the roving tension. If any of the sensor's heads does not operate correctly, the roving tension on all spindles will be affected.
For the correct control of roving tension, be sure to observe the following precautions:

(1) Do not touch roving on those three spindles equipped with a tension sensor (sensor-equipped spindles) when the FL is in operation.

(2) Do not interrupt the sensor detection area with hands or foreign objects when the FL is in operation.

(3) If any one of those sensor-equipped spindles fails to keep normal tension (due to short-wound cops, sliver grain error, clogged pipe, etc.), do not use that spindle.

(4) Do not apply strong force to the tension sensor itself.

(5) Periodically check that the flyer caps of those sensor-equipped spindles are firmly installed without any gap or inclination and not entangled with fly or fleece.

(6) Periodically (about once/day) call up the Tension Bit Display screen to see that no 999 indication (detection error) appears on the monitor area.
If 999 is displayed, wipe the tension sensor window with a soft cloth moistened with alcohol.

NEVER use a dirty cloth or a cloth contaminated with iron filings.

(7) If any tension-related error is noted, check the tension sensors according to the instructions given in Subsection 8.1.2 [2] [2.1] "The FL200 can continue running but no proper roving tension can be kept."

[7.3] Inching

When inching the FL, be sure to observe the following precautions:

(1) When inching around the bobbin shoulders, do not stop inching at the bobbin shoulders. Shoulders may be deformed.

(2) To start automatic winding after doffing, run the FL by pressing not the Inching switch but the Start switch for facilitating the automatic winding. (Refer to [7.1] Restarting after Doffing.)

(3) When modifying the flyer angle for piecing roving or other purposes, inch the FL. Do not turn the flyers by hand.

(4) To turn off the stop motion signal lamp, use the Stop switch not the Inching switch.

(5) If you stop the FL at full-bobbin state (when the doffing selection switch is set to the manual position), you can inch the FL. However, if you keep the inching switch held down for a long time, there is a danger that you will exceed the bobbin diameter, so please be careful.

[7.4] Doffing

During doffing, be careful with the following:

(1) When the bobbin rail is moving down to the doffing position

- Once the Bobbin Rail-down switch is pressed so that the bobbin rail starts down-movement, not only the Start switch but also the Inching switch becomes inoperative.
- In an emergency, to stop the bobbin rail halfway through the down-movement, press the Stop switch provided on the front of the FL.

(2) When the bobbin rail is moving up to the empty-bobbin loading position

- Do not put empty-bobbins or other objects on the bobbin rail before the bobbin rail reaches the empty bobbin loading position. If you do so, the empty-bobbin loading sensors (photoelectric switches) work so that the bobbin rail stops the up-movement. (See the note below.)
- You can confirm when the bobbin rail has reached the empty bobbin loading position, because the white signal lamp will change from being lit to a flickering state.

(3) When the bobbin rail is moving up to the winding start position

- Before pressing the Bobbin Rail-up switch, be sure to check that empty-bobbins are normally set and the pressers are correctly opened.
- After you have pressed the Bobbin Rail-up switch the bobbin rail will rise slowly up from the loading position for about 20 mm. After this it will rise up at its normal speed. Please be careful of this.
- Do not press the Stop switch for turning off the stop motion signal lamp before the bobbin rail reaches the winding start position. (See the note below.)
  If you do so, the bobbin rail stops before it reaches the winding start position. To restart the bobbin rail, it is necessary to press the Bobbin Rail-up switch again.

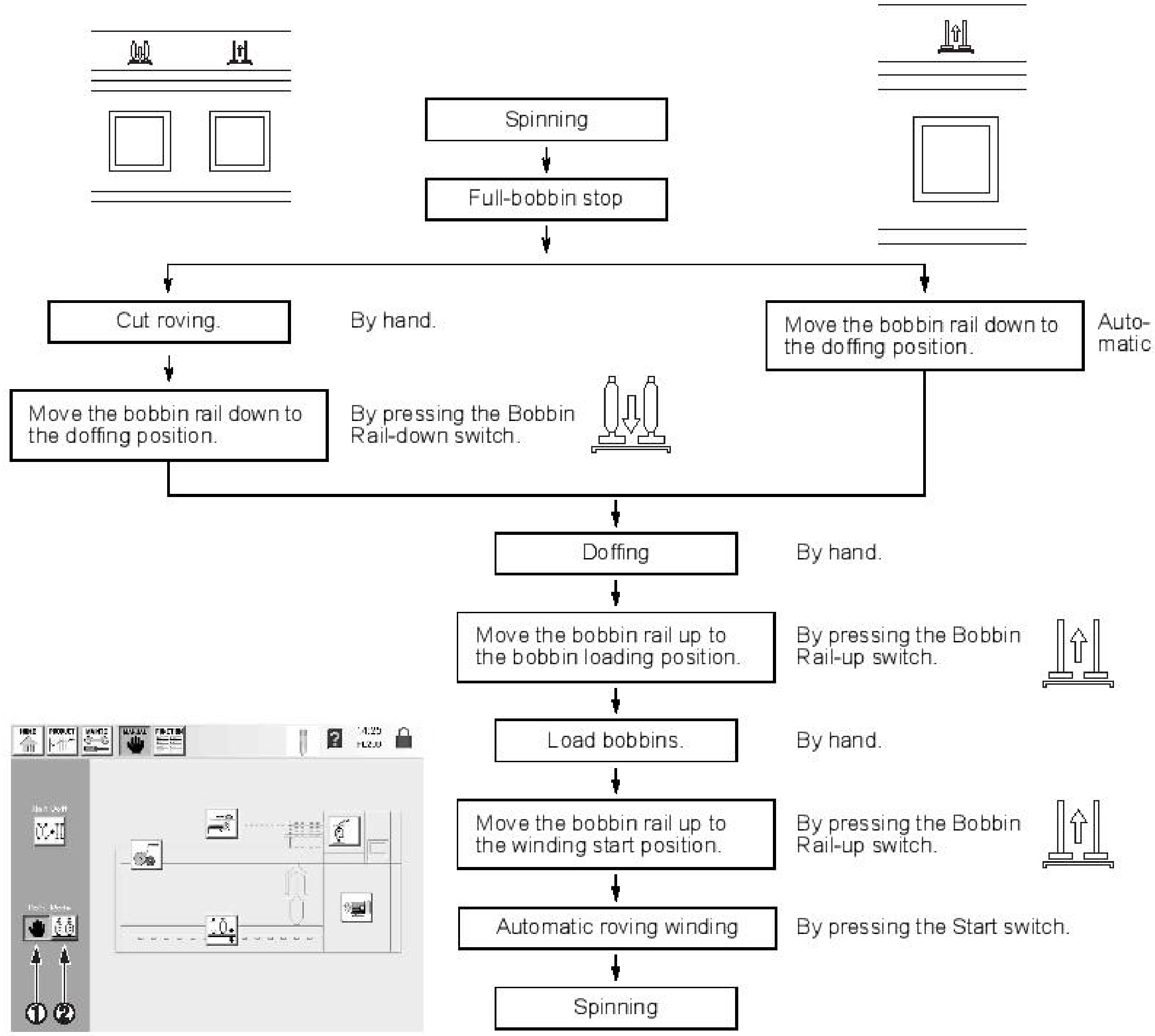
  NOTE: The bobbin rail slows down immediately before reaching the target position.
- You can confirm when the bobbin rail has reached the winding start position because the white signal lamp will stop flickering and will turn off.

4.1.3 Manual and Automatic Doffing Sequences

[1] Manual Doffing Sequence

(1)When the doffing selection switch is set to position ①.

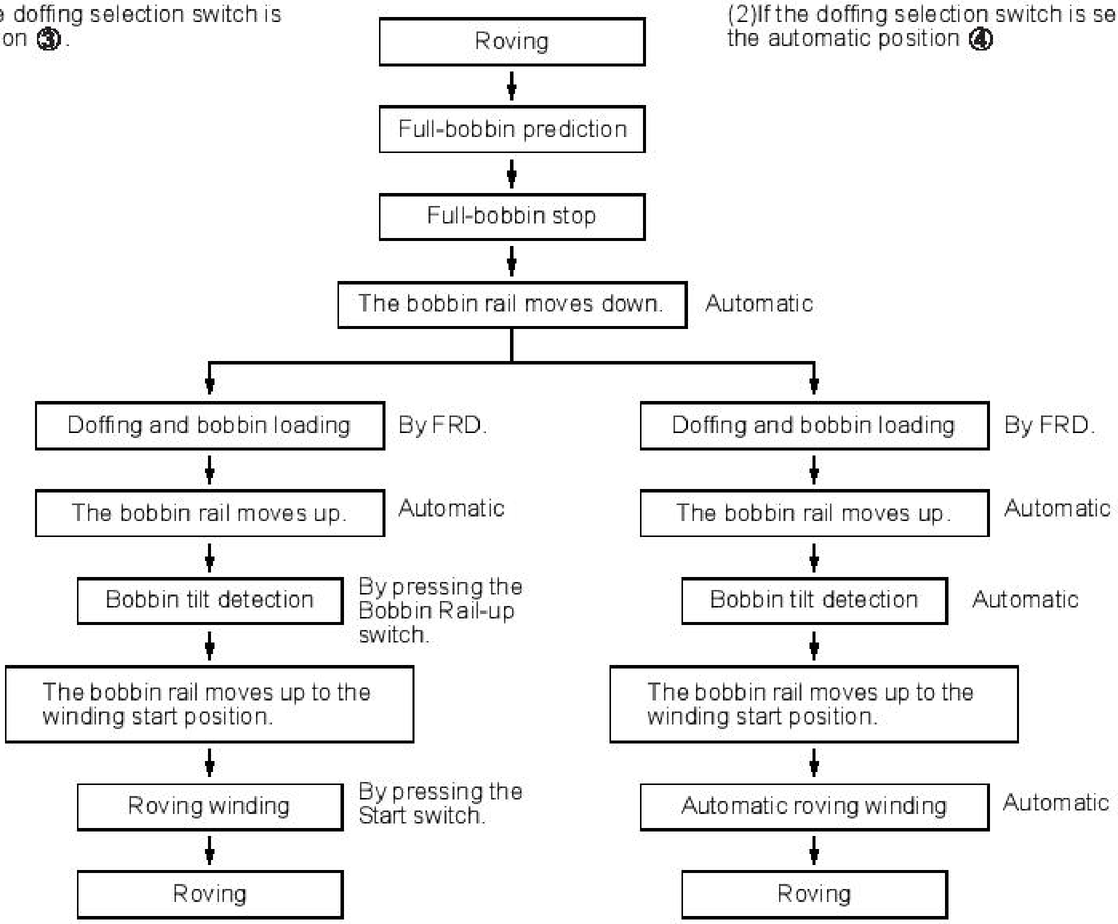
(2)If the doffing selection switch is set to the manual position ②

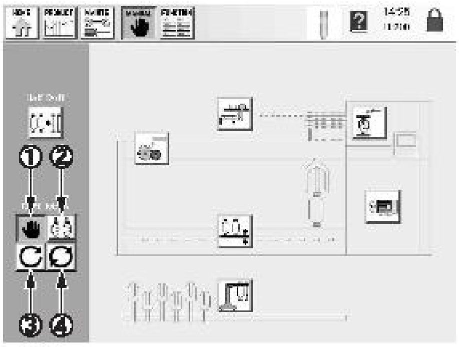

Spinning
Full-bobbin stop
Cut roving.
By hand.
Move the bobbin rail down to the doffing position.
Auto-matic
Move the bobbin rail down to the doffing position.
By pressing the Bobbin Rail-down switch.
Doffing
By hand.
Move the bobbin rail up to the bobbin loading position.
By pressing the Bobbin Rail-up switch.
Load bobbins.
By hand.
Move the bobbin rail up to the winding start position.
By pressing the Bobbin Rail-up switch.
Automatic roving winding
By pressing the Start switch.
Spinning
①
②

[2] Automatic Doffing Sequence with FRD

(1)When the doffing selection switch is set to position ③.

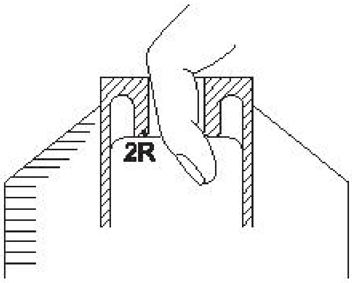
(2)If the doffing selection switch is set to the automatic position ④


Roving
Full-bobbin prediction
Full-bobbin stop
The bobbin rail moves down.
Automatic
Doffing and bobbin loading
By FRD.
The bobbin rail moves up.
Automatic
Bobbin tilt detection
By pressing the Bobbin Rail-up switch.
The bobbin rail moves up to the winding start position.
Roving winding
By pressing the Start switch.
Roving
Doffing and bobbin loading
By FRD.
The bobbin rail moves up.
Automatic
Bobbin tilt detection
Automatic
The bobbin rail moves up to the winding start position.
Automatic roving winding
Automatic
Roving



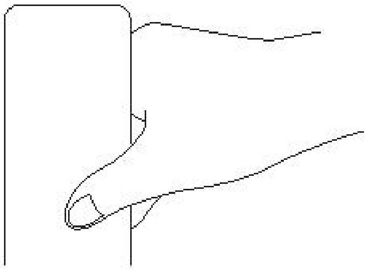
[3] How to Doff and Load Bobbins By Hand

Doffing by hand

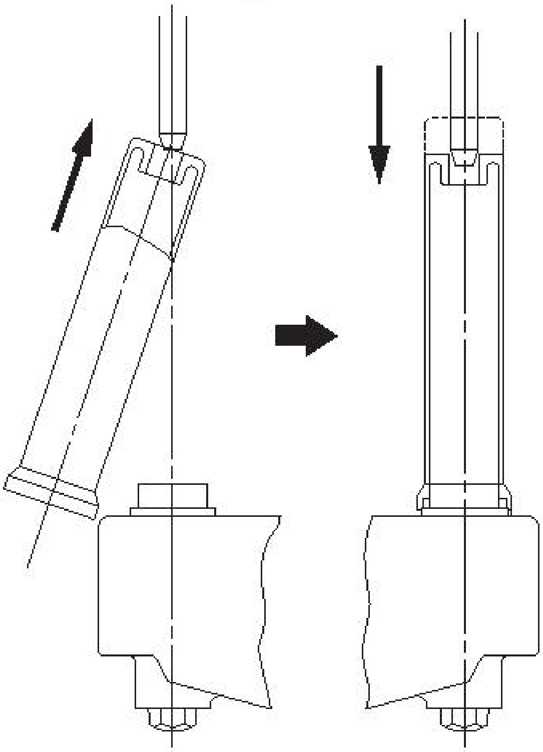


(1) Doffing
As shown at left, insert your finger into the hole provided in a bobbin, bend its tip to hook the bobbin, and lift up the bobbin for quick doffing.
It is recommended that you put on a finger-stall.
The corners inside a bobbin should be rounded for protection of your fingers.

Holding a bobbin



Loading a bobbin



(2) Loading bobbins
Hold the upper section of a bobbin, first fit its top over the flyer arbor, then lift it up slightly to fit its bottom onto the bobbin holder.

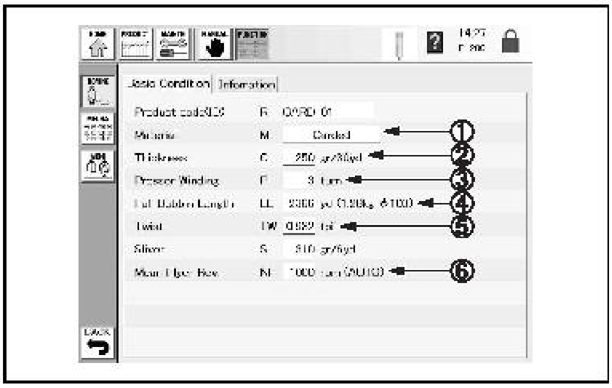
4.1.4 Setting the Operation Conditions

In order to operate this machine it is necessary to set at least the 14 items in the 3 categories listed below.

NOTE: Once the items in categories [2] and [3] have been set, it is not necessary to change them for each variety of material.

[1] Basic Roving Conditions

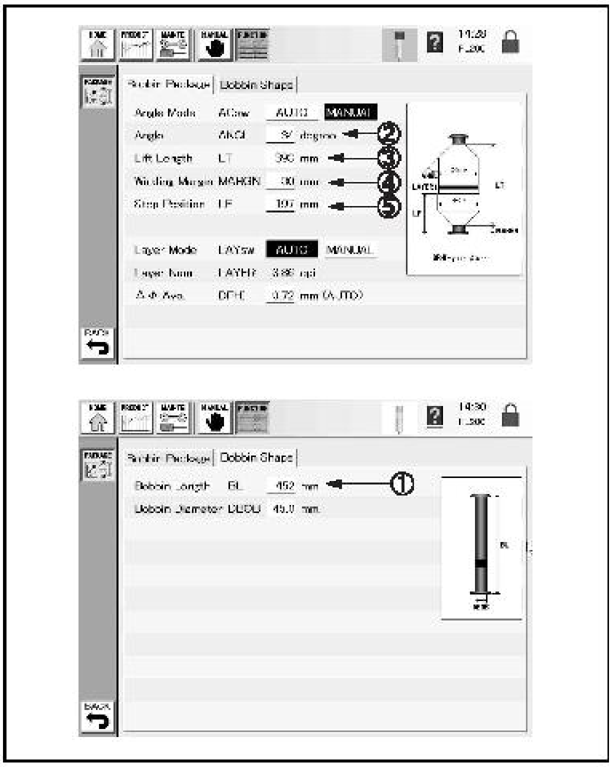
①Material
②Roving Thickness
③Number of Presser Windings
④Full Bobbin Length
⑤Number of Twists
⑥Number of Flyer Revolutions


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
14:27
BACK
Basic Condition
Information
①
②
③
④
⑤
⑥

Product code(ID) R CARD 01
Material M Carded
Thickness C 250 gr/30yd
Presser Winding P 3 turn
Full Bobbin Length LL 2300 yd (1.20kg/100)
Twist TW 0.929 tpi
Sliver S 310 gr/6yd
Mean Flyer Rev. N 1000 rpm (AUTO)

[2] Bobbin Configuration

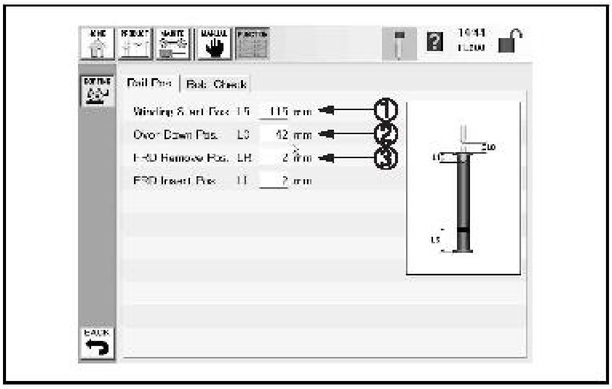
①Bobbin Length
②Shoulder Angle
③Lift Length
④Winding Margin
⑤Stop Position


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
14:29
14:30
PACKAGE
BACK
Bobbin Package
Bobbin Shape
LT
LF
BL
②
③
④
⑤
①

Angle Mode ACsw AUTO MANUAL
Angle ANGL 37 degree
Lift Length LT 390 mm
Winding Margin MARGIN 30 mm
Stop Position LF 197 mm
Layer Mode LAYsw AUTO MANUAL
Layer Num. LAYH? 3.86 cpi
Δ ϕ Ave. DFH 0.72 mm (AUTO)

Bobbin Length BL 452 mm
Bobbin Diameter DBOD 45.0 mm

[3] Bobbin Rail Stop Position


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
?
14:44
BACK
Rail Pos
Bob. Check
①
②
③
L5

Winding Start Pos. L5 115 mm

Over Down Pos. L3 42 mm

FRD Remove Pos. LR 2 mm

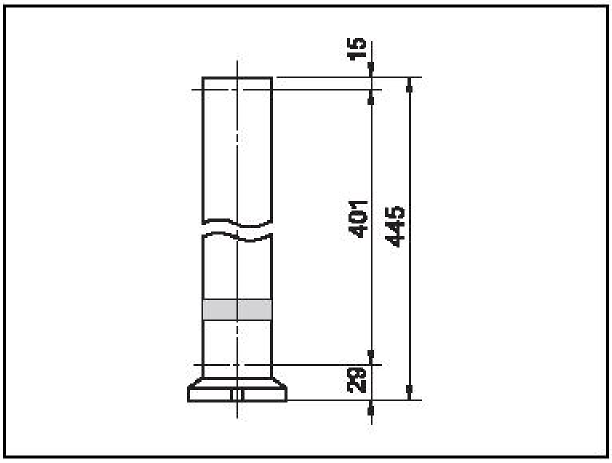
FRD Insert Pos. LI 2 mm

①Winding Start Position
②Doffing Position
③Empty Bobbin Removal Position

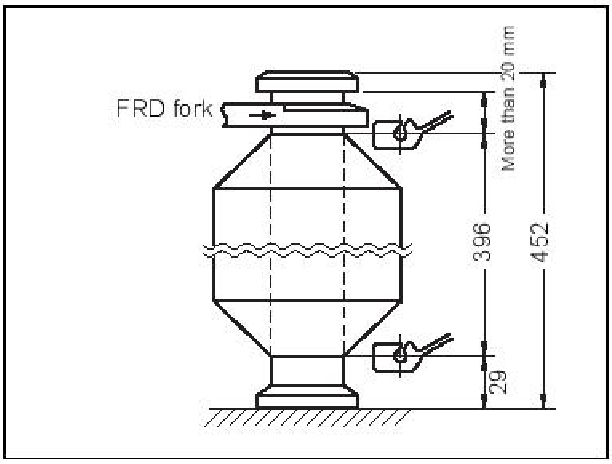
NOTE: Please refer to section "5.1 Operation Panel" for the setting instructions.

Caution 1 : Cautionary items for setting the lift length and winding margin

The lift length is the area on the bobbin that the roving will be wound on to.


15
401
445
29

- The standard lift length is 401 mm. This is the area that is 29 mm from the bottom of the bobbin to 15mm from the top of the bobbin.


FRD fork
More than 20 mm
396
452
29

- When using automatic doffing (FRD) a special specification bobbin is required.
  When doffing with the FRD it is necessary for the space at the top to be 20 mm or more so that the FRD forks will not touch the doffing.

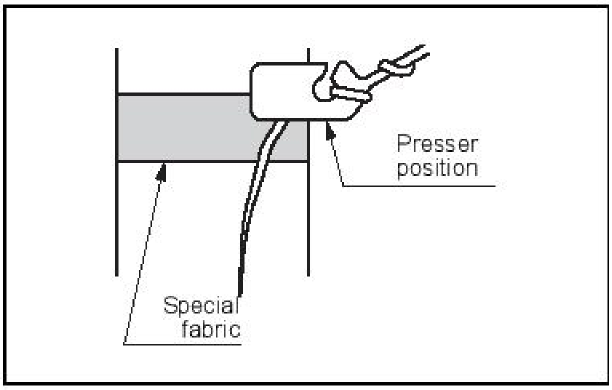
Caution 2: Cautionary items for setting the doffing position

In the standard specifications the doffing position is normally set to 42 mm.
In the FRD specifications the doffing position is set to 44 mm.

Caution 3: Cautionary items for setting the empty bobbin insertion position

IThe empty bobbin insertion position should be set so that there is 7 to 9 mm of space between the top of the bobbin and the flyer spindle. If the set value is smaller than this and the bobbin insertion margin also becomes smaller as a result, then the risk of a bobbin collision with the spindle increases due to the improper setting of the empty bobbins. Please be careful to not let this happen.

Caution 4: Cautionary items for setting the winding start position



Set the winding start position to be slightly higher than the place on the bobbin where the special fabric is wound so that the presser eye can reach.

4.1.5 Operation of the Bobbin Rail Up/Down Handle

NOTE: If you move the bobbin rail with the handle when the power is off, the rail position stored in the memory will become out of synch and you will not be able to operate the machine.
When the power is turned on again the "E-28 BOBBIN RAIL OUT OF POSITION" error message will be displayed.

You may move up and down the bobbin rail with this bobbin rail up/down handle.

(1) Turn the power on.

(2) Press the Emergency Stop button.

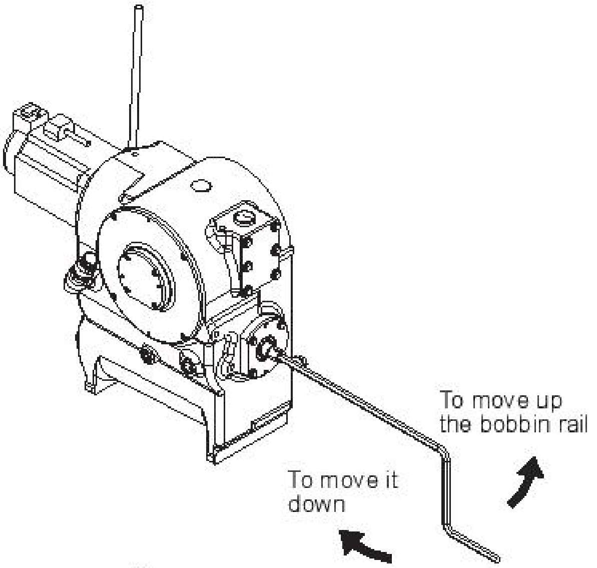
(3) Open the GE front door.

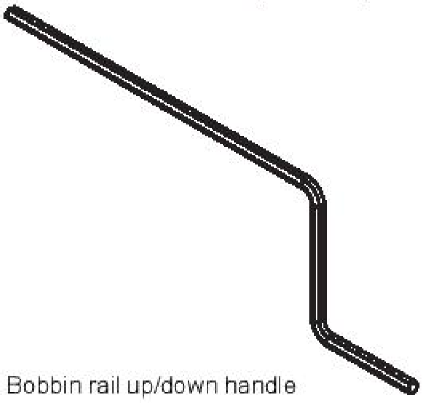
(4) Engage the bobbin rail up/down handle with the lifting box, then turn it clockwise or counterclockwise to move the bobbin rail up or down, respectively.

REFERENCE: If the "E-28 BOBBIN RAIL OUT OF POSITION" message appears,

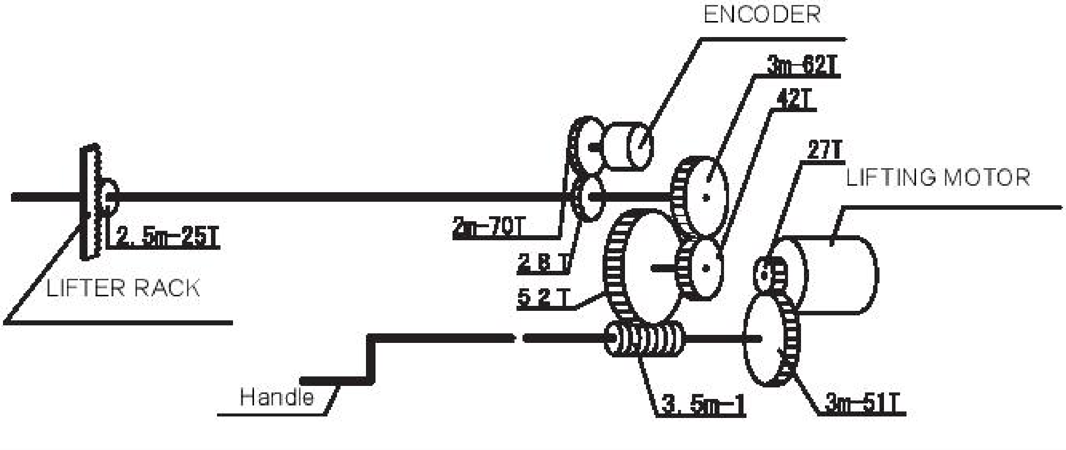
1) Press the Bobbin Rail-down switch on the operation panel to move the bobbin rail down to the doffing position.

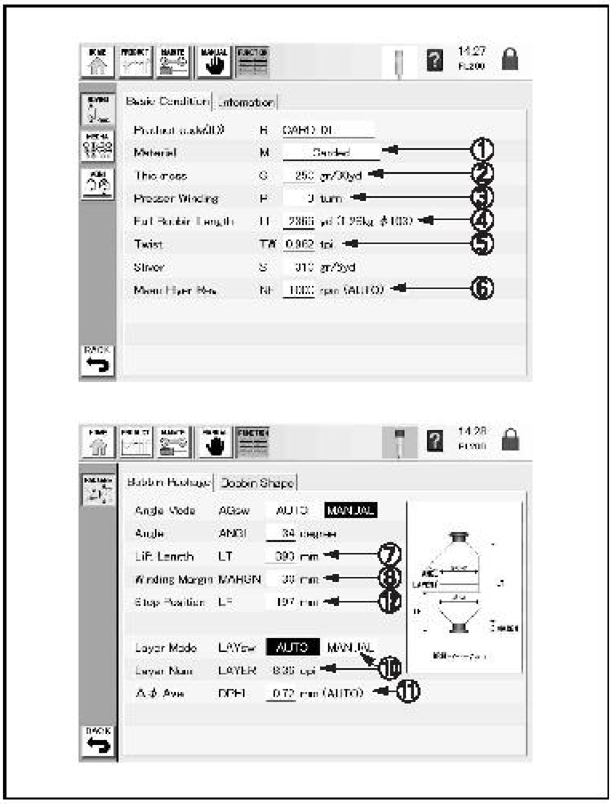
2) Touch the ALARM RESET key on the operation panel to remove the error message.


To move up
the bobbin rail
To move it
down



Bobbin rail up/down handle


ENCODER
3m-62T
42T
27T
LIFTING MOTOR
2.5m-25T
LIFTER RACK
2m-70T
28T
52T
Handle
3.5m-1
3m-51T



Basic Condition | Information

Product code(ID)	H	CARD 01
Material	M	Carded
Thickness	G	250 gr/30yd
Presser Winding	P	3 turn
Full Bobbin Length	LL	2865 yd (1.95kg #103)
Twist	TW	0.962 tpi
Sliver	S	310 gr/6yd
Main Flyer Rev.	NF	1000 rpm (AUTO)

Bobbin Package | Bobbin Shape

Angle Mode	AGsw	AUTO MANUAL
Angle	ANGL	34 degree
Lift Length	LT	390 mm
Winding Margin	MARGN	30 mm
Stop Position	LF	197 mm
Layer Mode	LAYsw	AUTO MANUAL
Layer Num	LAYER	8.35 cpi
Δϕ Ave	DPHI	0.72 mm (AUTO)

4.1.6 Changing the Set Data

[1] Set Data that Should not to be Modified During Roving

① Material (Sliver type)
② Thickness (Roving thickness)
③ Presser Winding (Number of windings on the pressers)
④ Full Bobbin Length
⑤ Number of Twists
⑥ Number of Flyer Revolutions (Flyer speed)
⑦ Lift Length
⑧ Winding Margin
⑨ Bobbin Length
⑩ Layer Number (Number of layers)
⑪ Delta ø
⑫ Stop Position

[2] When to Change the Set Data

You should only change the set data once the doffing has finished and the bobbin rail is at the doffing position.
Please refer to Section “5.1 Operation Panel” for the method to change the set data.

Section 5.1
Operation Panel

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5.1 Operation Panel

5.1.1 Overview

The operation panel is on the control box located at the GE.

It consists of a function panel and operation switches and enables the following.

(1) Setting the roving conditions (including delivery grain, number of twists, flyer speed (rpm), and production length)

(2) Setting the shape of the bobbin of roving (including lift length, shoulder angles, and number of layers)

(3) Operating the FL manually (e.g., moving the bobbin rail up/down, rotating individual shafts separately doffing halfway through roving, and adjusting the tension of the delivery roving)

(4) Monitoring the running status (e.g., current running information, daily running information, and stop motion information per doffing)

(5) Monitoring the production management data (e.g., shift schedule and weekly production information for shifts)

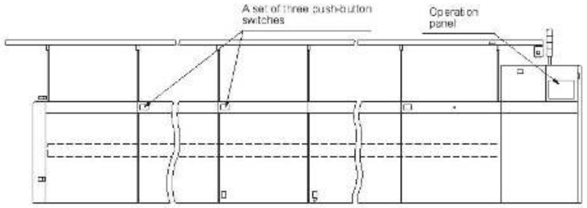
(6) Monitoring the maintenance information (e.g., maintenance interval specification and warnings)

(7) Displaying error information (e.g., current error contents, remedies, and error logs)

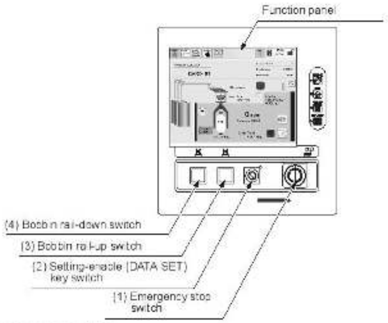
(8) Saving and reading the setting data into/from a memory card

The function panel is of a touch panel type that allows you to switch the display just by touching the surface of the screen. It uses colors, buttons, and images for easy-to-see screen structure.

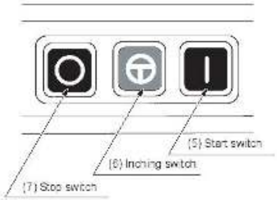
5.1.2 Description of Operation Panel


A set of three push-button switches
Operation panel

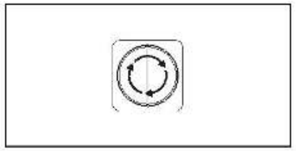
- Operation panel


Function panel
(4) Bobbin rail-down switch
(3) Bobbin rail-up switch
(2) Setting-enable (DATA SET) key switch
(1) Emergency stop switch

- A set of three push-button switches
  A set of these switches is provided every two blocks.

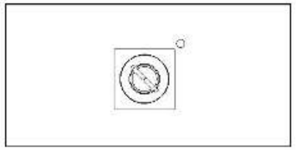

(5) Start switch
(6) Inching switch
(7) Stop switch

[1] Names and Functions of Switches



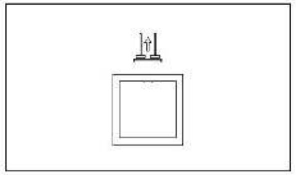
(1) Emergency switch (red)
To stop the FL in an emergency, press this switch.

- Pressing this switch shuts down the main power circuit so that the FL comes to a synchronous stop with regenerative energy. (The switch is locked.)
- To release the lock, turn this switch clockwise.



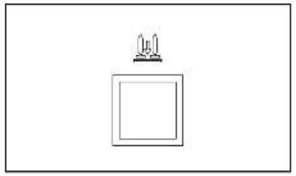
(2) Setting-enable (DATA SET) key switch
Inserting the setting-enable key into this switch and turning it to the green ● position allows you to set and modify the setting data. (When the key is in this position, it cannot be removed.)

NOTE: This key switch protects some operations provided on the function panel against accidental access. [Refer to Section 5.1.10. [4].]

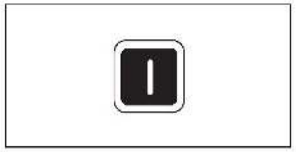


(3) Bobbin rail-up switch
After doffing, to move the bobbin rail up to the empty-bobbin loading position or winding start position, press this switch.

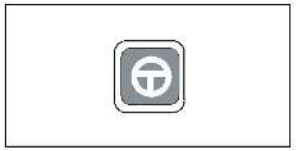
NOTE: Once roving starts, this switch is disabled.



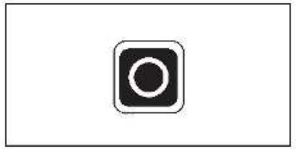
(4) Bobbin rail-down switch
After a full-bobbin stop, to move the bobbin rail down to the doffing position, press this switch.



(5) Start switch (black)
To run the FL, press this switch.



(6) Inching switch (gray)
To inch the FL, press this switch. While this switch is held down, the FL inches.



(7) Stop switch (red)
To stop the FL being in motion, press this switch.

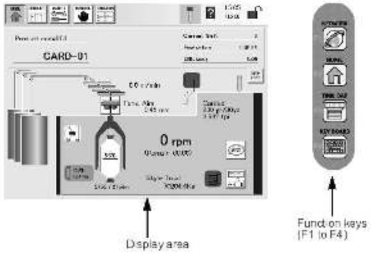
[2] Function Panel

Use this panel for monitoring, data setting and manual switch operation.

- Monitoring the roving status
- Checking the data settings
- Setting data on the screen

Basic key functions on the function panel are described below.

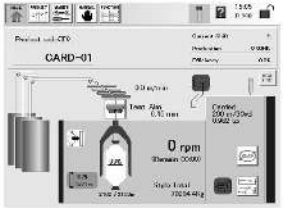
[2.1] Function keys (F1 to F4)



The function panel consists of the display area (color touch panel, 800 × 640 dots) and four function keys. In actual operation, the display area is used to switch screens or change the setting data by touching the surface of the display. The function keys (F1 to F4) are used for the following.

• F1 (NETWORK) key	Touching the F1 key calls up the network screen where you enter the FL's IP address and other network related items and refer to the function panels of other FLs. **NOTE:** This key is provided only for the TMS versions. Refer to the TMS instruction manual.
• F2 (HOME) key	Touching the F2 key returns to the home screen (main screen that appears when the power is turned on). **NOTE:** Use this key to return from the network screen or when there is trouble with the screen display or operation.
• F3 (TOOL BAR) key	Touching the F3 key calls up the tool bar (usually not displayed) on the top of the screen.
• F4 (KEYBOARD) key	Touching the F4 key calls up the keyboard. **NOTE:** Use this keyboard to make settings on the network screen.

[2.2] Screen configuration (Description of the top menu)



The figure at left shows an example of the display screen. The display area has touch-sheet switches.

Touching one of the five buttons (icons) on the left-hand side of the top menu switches between the display modes. The currently selected display mode button is indicated in green.

Each display mode shows buttons on the whole screen and/or in the sub menu vertically shown at the left end of the screen. Touching the target button switches the screen. The currently selected sub menu button is indicated in orange.

■ Description of the top menu

HOME button HOME	Touching this button calls up the main screen (Main mode).	See Section
	• Shows the real-time data of the FL running status and production state.	5.1.2, [2.5].
	• Allows fine adjustment of the target tension values.	
PRODUCT button PRODUCT	Touching this button calls up the production information screen (Production mode). This screen shows:	
	• Report containing the transition of the production length and operating rate (efficiency) in the past one week.	See Section 5.1.3, [2].
	• Total counter	See Section 5.1.3, [3].
	• Production log for each roving condition (past 30 records)	See Section 5.1.3, [4].
	This screen allows you to:	
	• Make out an automatic shift change schedule.	See Section 5.1.3, [5].
	• Configure the system clock.	See Section 5.1.3, [6].
MAINTE(nance) button MAINTE	Touching this button calls up the FL running status monitor (Maintenance mode). This monitor shows:	
	• Measured values roughly, e.g., the current rpm of each shaft.	See Section 5.1.4, [2].
	• FL running state in the past 24 hours graphically.	See Section 5.1.4, [3].
	• Message log (trouble log and operation log of the past 100 records)	See Section 5.1.4, [4].
	• Input/output information (I/O monitor)	See Section 5.1.4, [5].
	This monitor allows you to:	
	• Set up the maintenance alarm items and their pop-up intervals for maintenance purpose.	See Section 5.1.4, [6].

MANUAL button

Touching this button calls up the manual operation screen (Manual mode) which allows you to perform:

- Halfway doffing — See Section 5.1.5, [9]
- Doffing mode change — See Section 5.1.5, [1]
- Greasing — See Section 5.1.5, [5]
- Cleaning unit operation — See Section 5.1.5, [2] and [3]
- Manual operation for driving motors individually — See Section 5.1.5, [8]

FUNCTION button

Touching this button calls up the function menu (Function mode) which allows you to:

- Set up the roving delivery conditions, the shape of a bobbin of roving, and other basic conditions. — See Sections 5.1.6 through 5.1.9
- Make user settings including the FL model and display unit. — See Section 5.1.10.
- Make FL initial setting/adjustment and device settings. — See Sections 5.1.12 and 5.1.13
- Access memory cards. — See Section 5.1.14.

TROUBLE button

No message (not colored)

Message existent (blinking in red)

Touching this button calls up the trouble message screen which displays:

- Contents of current trouble and the resetting procedure

NOTE: If any trouble message exists, this button blinks in red.

NOTE: If trouble occurs, the trouble message screen appears with the current display mode unchanged.

HELP button

Touching this button calls up the help screen which shows:

- Program version
- FL basic specifications
- Contents of typical trouble for reference
- Reference data for FL adjustment

NOTE: The help screen appears with the current display mode unchanged.

13:40

FL200

Upper row: Current time

Lower row: FL model

Key locked

Key unlocked

Key Switch Status Icon

This icon shows the status of the setting-enable (DATA SET) key switch.

NOTE: Turning the setting-enable (DATA SET) key switch to the DATA SET position (green) changes this status icon to the "Key unlocked" one.

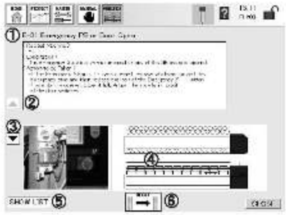


Fig. 1 Trouble message screen

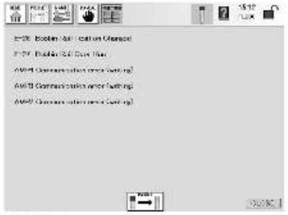


Fig. 2 Trouble list screen

[2.3] Trouble message screen and alarm reset operation

(1) Trouble message screen
If trouble occurs, the function panel is switched to the screen shown in Fig. 1.

Components of the trouble message display

①Trouble message (E- ✱✱ and message)

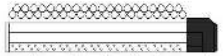
②Contents of trouble (Related machine, explanation, and action to be taken)

③Photo related to trouble detected

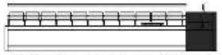
NOTE: Some types of trouble do not display related photos.

④Location of trouble detected

- Viewed from the top



- Viewed from the function panel side (RH side)



NOTE: The location of trouble detected flashes in red.

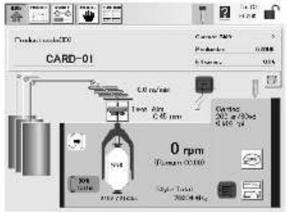
(2) Trouble list screen
If more than one trouble occurs, the SHOW LIST switch appears in the bottom left corner (⑤) of the trouble message screen shown in Fig. 1.
Touching this switch calls up the trouble list screen shown at left.

Tip: Touching each error message on the trouble list screen calls up the respective trouble message screen.

(3) Alarm reset operation
To clear the trouble message, perform an alarm reset operation by touching the RESET button (→) at the bottom of the trouble message screen.

(4) Closing the trouble message screen temporarily
The trouble message screen can be temporarily closed. To see the check screen for I/O reference or any other screen when trouble cannot be removed, touch the CLOSE switch provided in the bottom right corner of the trouble message screen shown in Fig. 1.

To call up the trouble message screen again, touch the trouble display button ▮ in the top menu.
The button flashes in red when trouble occurs, indicating existence of a trouble message.



[2.4] Basics of setting

[2.4.1] Setting the roving conditions

- This section describes the setting change procedure, taking an example of how to change the roving thickness (g/yard) out of the roving conditions.

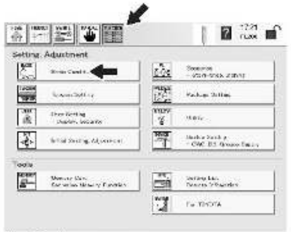


Fig. 1 Function menu screen

(1) Touch the FUNCTION button in the top menu, and the function menu screen appears as shown in Fig. 1.

FUNCTION button

(2) Touch the BASIC button, and the basic conditions screen appears as shown in Fig. 2.

BASIC button

- To set mechanical adjustment values, touch the sub menu (vertically shown at the left end of the screen) to switch to the desired screen.
- When a screen having the sub menu is called up, the button located at the top of the sub menu is always selected.

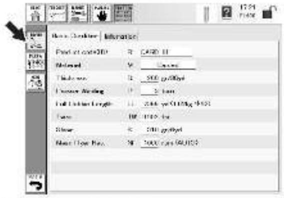


Fig. 2 Basic conditions screen

- On a screen having the sub menu, to return to the previous screen, touch the BACK button.

BACK button

- To call up any other screen, touch buttons in the top menu.

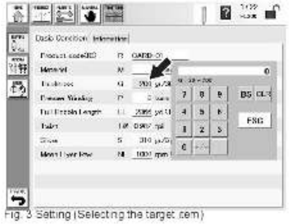


Fig. 3 Setting (Selecting the target item)

(3) Change the setting (Thickness: gr/30 yd in this example) using the following steps.

1) Make sure that the FL is stopped.
   - When an emergency stop (E--01) has occurred, no setting change is allowed.

   NOTE: The basic roving conditions should not be changed halfway through roving operation.
   - except some settings.

2) Turn the setting-enable (DATA SET) key to the DATA SET position. (This step is essential for changing settings.)

3) Touch the entry field (white background) of the target item to be changed, and the numerical keypad appears together with the CANCEL and SET buttons as shown in Fig. 3.
   - The selected entry field turns yellow from white.

4) Enter the desired value using the keypad. (Fig. 4 shows changing the thickness from 200 to 250.)
   Touch 2, 5, 0, and ENT.

- Use the same way as above to change settings of other items.
- About keypad

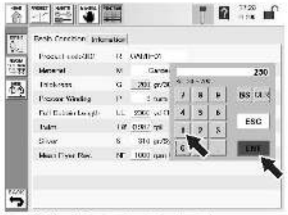
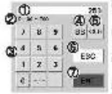
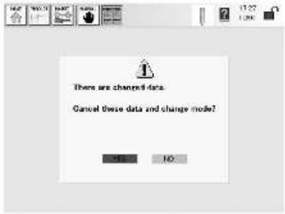


Fig. 4 Setting (Entering the desired value)



① Displays a newly entered value.
② Displays the allowable entry range.
③ Keys (0 to 9, +/-, and period)
④ BS key (Backspaces for new entry.)
⑤ CLR key (Clears the new entry.)
⑥ ESC key (Cancels the new entry and closes the keypad.)
⑦ ENT key (Establishes the new entry and closes the keypad.)

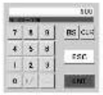


There are changed data.

Cancel these data and change mode?

Fig. 5 Setting (Switching screens halfway through the setting change procedure)

- The allowable entry range is shown on the keypad. If any value out of the range is entered as shown below, the ENT key becomes disabled.



- When changing settings of other items, it is possible to switch screens within the sub menu. However, switching screens using the top menu is basically prohibited.

  Touching the top menu halfway through the setting change procedure displays the confirmation screen shown in Fig. 5, asking whether the newly entered value should be established or canceled.

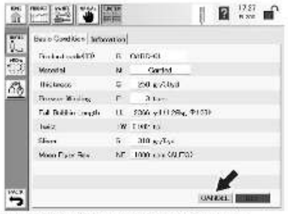


Fig. 6 Setting (Before establishment of new entry)

5) After entry of the desired value, check again that the entry is correct and then touch the SET button (Fig. 6) to start the processing.

- If the setting is password-protected (user setting), the password entry window appears where you enter the password correctly.

  The "Processed normally" message appears, indicating the completion of the setting. (Turn the setting-enable (DATA SET) key back to the original position.)

  The CANCEL and SET buttons disappear.

  If any error occurs, check the contents and perform the setting procedure again.

- Touching the CANCEL button clears the new entry.

[2.4.2] Cop-related setter on a wound percentage basis

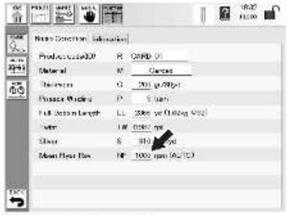


Fig. 1 Basic conditions screen

When configuring the flyer speed change pattern, roving tension target, Δ ϕ of package diameter, and others in the MANUAL mode, use the cop-related setter to make settings on a wound percentage basis (increments of 10%).

Entry procedure (for flyer speed change pattern)

(1) On the Basic Conditions screen, touch the entry field of the Mean Flyer Rev., and the Flyer Pattern window appears.

(2) Select the MANUAL mode button, and the cop-related setter on a wound percentage basis appears as shown in Fig. 2. Not a numerical entry but touching the screen accesses the cop-related setter.

The x-axis is a wound percentage (%) scale, and the y-axis, an entry value scale.

The vertical zone at the currently selected n% wound cop is highlighted with a white background.

Touch any of the following buttons (shown in Fig 1 to select the target percentage wound cop.

(3) When changing the flyer speed from 1000 to 1100 for the 0% wound cop, for example, touch the ▲ button located at the right side of the screen several times.

NOTE: To greatly change the value, directly touch the area near to the desired value in the highlight and then adjust the value using the ▲ and ▼ buttons.

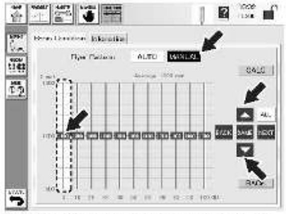


Fig. 2 Cop-related setter on a wound percentage basis (for flyer speed change pattern)

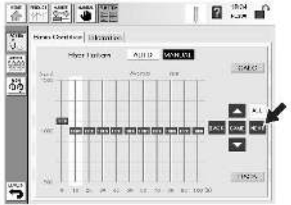

Flyer Pattern
AUTO
MANUAL
BACK
SAME
NEXT

Fig. 3

(4) When applying the same value (1100) specified for the 0% wound cop to the 10% wound cop, for example, touch the NEXT button to move the highlight to the scale for the 10% wound cop as shown in Fig. 3.

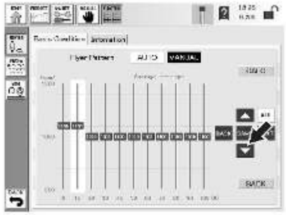

Basic Condition
Information
Flyer Pattern
AUTO
MANUAL
BACK
BACK

Fig. 4

(5) Touch the SAME button, and the value specified for the 0% wound cop applies to the 10% wound cop.

(6) When applying the same value to the 20% to 70% wound cops, for example, touch the NEXT and SAME buttons repeatedly in the same way.

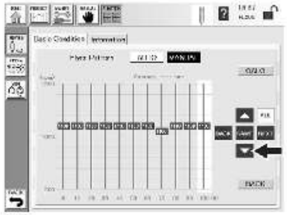

Basic Condition
Information
Flyer Pattern
AUTO
MANUAL
BACK
SAME
NEXT
BACK

Fig. 5

(7) When decreasing the value (1100) preset for the 70% wound cop to 1050, for example, touch the ▼ button several times.

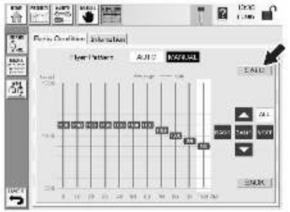

Basic Condition
Information
Flyer Pattern
AUTO
MANUAL
CALC
ALL
BACK
SAME
NEXT
BACK

Fig. 6

(8) After making settings up to the 100% wound cop, touch the CALC (calculation) button to update the average value.

(9) Check that all settings made for the 0% to 100% wound cops are correct, then touch the BACK button to return to the previous screen.

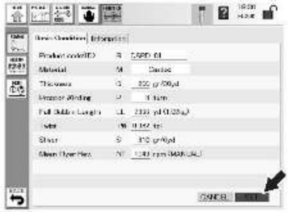
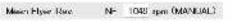

Basic Conditions
Information
Product code(ID)
Material
Thickness
Pressor Winding
Full Bobbin Length
Twist
Sliver
Mean Flyer Rev.
CANCEL
SET

Fig. 7

(10) On the BASIC Conditions screen, the updated Mean Flyer Rev. and selected mode (MANUAL) are displayed.



Mean Flyer Rev. NF 1040 rpm (MANUAL)

(11) Check that there is no problem with the new entry and then touch the SET button to finish the setting procedure.

- About operation buttons

[BACK] ... Moves the selection back to the previous wound cop by one.

[▲] ...... Increases the entered value. (The amount of change depends upon the selected item.)

[SAME] ... Applies the same value specified for the previous wound cop to the currently selected wound cop.

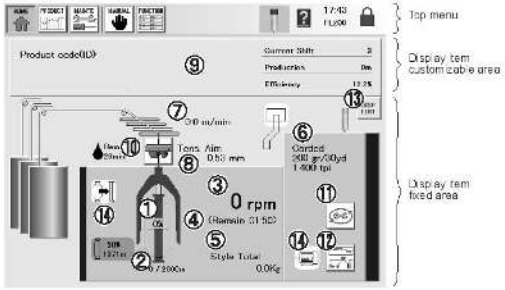
[▼] ...... Decreases the entered value. (The amount of change depends upon the selected item.)

[ALL] ...... Selects all of percentage wound cops. (Use this button to thoroughly change entered values.)

[NEXT] ... Moves the selection to the next would cop.

[2.5] Main (Home) screen

(1) Overview


Top menu
17:43
Product code(ID)
Current Shift 3
Production 0m
Efficiency 12.2%
Display item customizable area
0.0 m/min
Tens. Aim 0.53 mm
Carded
200 gr/30yd
1.400 tpi
0 rpm
(Remain 01:50)
0%
Style Total 0.0Kg
0 / 2000m
Display item fixed area
①
②
③
④
⑤
⑥
⑦
⑧
⑨
⑩
⑪
⑫
⑬
⑭

Display items on the main (home) screen

① Current production percentage	Shows the bobbin shape and wound percentage.
② Current delivery length/Full bobbin length	
③ Flyer speed	Shows the flyer rpm commanded.
④ Remain	Shows the remaining time before full bobbin (anticipation).
⑤ Style Total	Shows approximate total production since roving conditions have changed. (It is calculated from the specified grain, production length, and number of spindles used.)
⑥ Roving conditions	Shows the material, roving thickness (g/yard), and twists per inch. (These roving conditions can be displayed or hided with the user setting.)
⑦ Delivery speed	Shows the delivery speed commanded.
⑧ Target tension (Tens. Aim)	
⑨ Product code (ID)	(The product code appears when it is entered in [2.5], "(6) Display item customization.")
⑨ Shift production information	Shows the shift number, shift production, and operating rate for shifts. (See [2.5] "(6) Display item customization.")
⑩ Tension info display button	Touching this button calls up the tension info display that shows the tension graph and allows the fine adjustment of the target tension. (See "(4) Tension info display (Shows tension graph and allows fine adjustment of the target tension).")
⑪ Maintenance interval warning button	Shows the maintenance interval warning. Touching this button calls up the maintenance work start/stop screen. (See "(3) Maintenance interval warning.")
⑫ Running info display button	Touching this button calls up the running info display of the current doffing. (See "(5) Running info display.")
⑬ DISP(lay) EDIT button	Touching this button calls up the display item selection window for the customizable area. (See "(6) Display item customization.")
⑭ Status monitor icons	Show the current FL status, cleaner status, greasing status, etc., according to colored state of their icons. (See "(2) Status monitor.")

(2) Status monitor

The status monitor icons visually show the current status of the following with colors. Basically colors are assigned as follows.

Colorless = Normal stop. Green = In running, Red (flashing) = Abnormal stop

1. FL status

Colorless: At an ordinary stop
Green: In running
Red: At an abnormal stop
Yellow: At a full-bobbin stop
Blue: At a stop by the stop motion

2. Cleaner status

Colorless: At an ordinary stop
Green: In running
Red: At an abnormal stop
Light green (flashing): On standby for operation

3. FRD status (Only when the FL is equipped with an FRD.)

Colorless: At an ordinary stop
Green: In running
Red: At an abnormal stop

4. Greasing display (Comes ON during greasing for flyer gears and bobbin gears.)

Remain
28min

Yellow: Greasing (Remaining time being displayed)
No icon displayed: Greasing stopped

5. Halfway doffing display (Comes ON when the scheduled doffing or halfway doffing is booked.)

Green: Halfway doffing booked (Booked delivery length and wound percentage being displayed)
No icon displayed: In ordinary running

(3) Maintenance interval warning

The maintenance interval warning button provided in the bottom right corner of the main (home) screen visually shows the maintenance interval warning and maintenance work in progress with colors.

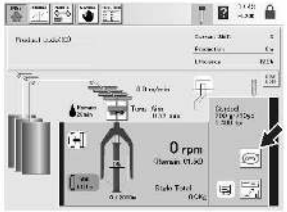
Basically, colors are assigned as follows.

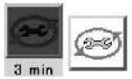
Colorless = No warning, Red (flashing) = Warning in effect, Brown = Maintenance in progress

NOTE: To show the warning, the maintenance names should be specified beforehand on the screen called up by touching the MAINTE and CYCLE buttons (see the next page).

NOTE: When it is not necessary to use this warning function, the maintenance interval warning button can be hided with the User Setting.

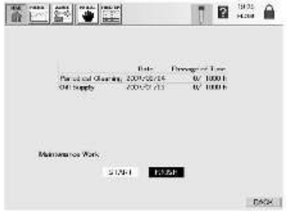
1.





Colorless: Normal state with no warning
Red: Maintenance warning in effect
Brown: Maintenance in progress

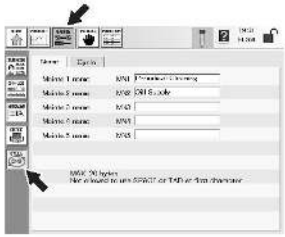
- Touching this button calls up the maintenance details screen at which you clear warnings, start or finish maintenance work.
- Touching the START button displays the maintenance time elapsed.


Date
Passage of Time
Maintenance Work
START
FINISH
BACK

- Maintenance details screen
  Maintenance name
  Date: Year/month/date when the last maintenance work is performed
  Passage of Time: Total run time (hours) elapsed after the last maintenance work

NOTE: The above information provides accurate data if maintenance names and others have been entered.

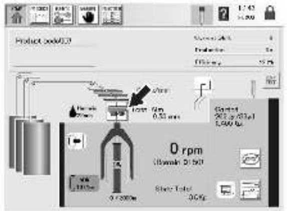
- Buttons
  START button:
  Touch this button to start maintenance work.
  FINISH button:
  Touch this button when the maintenance/replacement work has been completed.
  BACK button:
  Touch this button to return to the main (home) screen.


MN1
MN2 Oil Supply
MN3
MN4
MN5

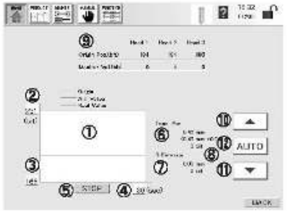
- To set up the warning interval, touch the MAINTE button in the top menu and the CYCLE button in the sub menu to call up the maintenance configuration screen.
  Touch the Cycle tab.

MAINTE
CYCLE

(4) Tension info display (Shows tension graph and allows fine adjustment of the target tension)
Touching the tension info display button on the main (home) screen calls up the tension info screen that shows the real-time tension data and allows fine adjustment of the target tension.



Tension info display button



Display items

① Tension graph	Shows the real-time tension data graphically. (Touching this area enlarges the graph.)
- - - - - -	Origin position
——	Target tension
——	Actually measured tension

NOTE: Using the above three items can change the scale of the graph

② Vertical maximum scale	255 bits
③ Vertical minimum scale	0 bit
④ Graph update interval	10 to 30 seconds

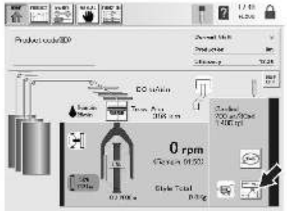
NOTE: To temporarily stop updating the graph, touch the STOP button (⑤). To restart updating, touch the button again

⑥ Target tension (Tension Aim)	Target tension values (mm, bits, and offset from AUTO value)
⑦ Difference	Difference from the current target value (mm and bits)
⑧ Feedback control	When the feedback control is active, three fine adjustment buttons for the target tension are displayed.)
⑨ Bit info for heads	The origin position and currently monitored value for each head are expressed in bits.

Tension adjustment buttons (enabled only when the AUTO tension target value is selected

⑩ UP button	Touching this button increases the target tension by decreasing the roving deflection by 0.05 mm per touch.
⑪ DOWN button	Touching this button decreases the target tension by increasing the roving deflection by 0.05 mm per touch.
⑫ AUTO button	Touching this button reverts the target tension to the reference value (AUTO value).

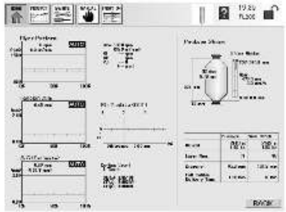
(5) Running info display
Touching the running info display button on the main (home) screen calls up the current doffing status window that shows the current roving conditions and the current real-time data.



Running info display button

The preset values and real-time values of the following items are displayed.

- Flyer speed change pattern
- Roving tension target
- Δ ϕ of package diameter
- Bobbin package shape
- Simulation data (number of layers, package diameter, and full bobbin delivery time)



(6) Display item customization

The display items in the customizable area of the main (home) screen can be customized.

- Turning the setting-enable (DATA SET) key to the DATA SET position (green ● position) and touching the DISP EDIT button calls up the display item selection window (shown in Fig. 2) where you can select items to be displayed in the customizable area.

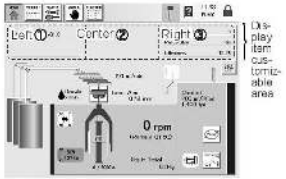


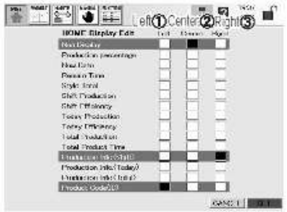
Fig. 1 Main (home) screen

DISP EDIT

DISP EDIT button

NOTE: The display item customizable area consists of three sections—left, center and right as shown at the left. For each section, select items to be displayed.

- On the display item selection window shown in Fig. 2, select check boxes of items to be displayed by touching them. After completion of selection, touch the SET button.



HOME Display Edit	Left	Center	Right
Non Display	☐	■	☐
Production percentage	☐	☐	☐
Now Date	☐	☐	☐
Remain Time	☐	☐	☐
Style Total	☐	☐	☐
Shift Production	☐	☐	☐
Shift Efficiency	☐	☐	☐
Today Production	☐	☐	☐
Today Efficiency	☐	☐	☐
Total Production	☐	☐	☐
Total Product Time	☐	☐	☐
Production Info(Shift)	☐	☐	■
Production Info(Today)	☐	☐	☐
Production Info(Total)	☐	☐	☐
Product Code(ID)	■	☐	☐

Fig. 2 Display item selection window

NOTE: Display items selectable

- Hide (Non Display), which should be selected to display nothing in the customizable area
- Current production percentage
- Current date
- Remaining time before full bobbin
- Style total (Total production with new style)
- Shift production
- Shift efficiency (Operating rate for shifts)
- Today production
- Today efficiency (Today's operating rate)
- Total production
- Total production time
- Production info (Shift)–Current shift, current shift production and operating rate
- Production info (Today)–Production per day and operating rate
- Production info (Total)–Total production and total production time
- Product code (ID)

(7) Sliver consumption & sliver change info screen

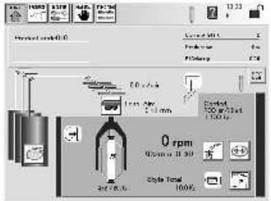


Fig. 1 Main (home) screen

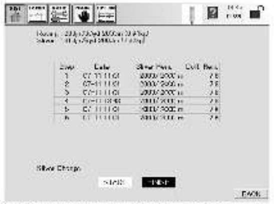


Fig. 2 Sliver consumption & sliver change info screen

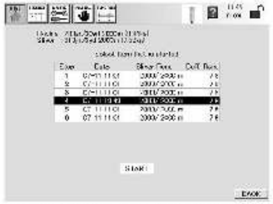


Fig. 3 Sliver change block (setup) selection screen

Touching the sliver button* on the main (home) screen calls up the sliver consumption & sliver change info screen as shown in Fig. 2.

Sliver button

The sliver consumption & sliver change info screen shows the sliver consumption prediction which is based on the settings made on the sliver configuration screen called up by selecting FUNCTION | BASIC. (Refer to Section 5.1.6. [3].)

NOTE: The sliver button can be displayed or hided on the User Setting screen.

1) Sliver consumption & sliver change info screen (Fig. 2)

Display items

- Roving to be delivered (preset)
- Sliver to be used (preset)
- Sliver consumption data (for each setup)
    1. Last replacement date of sliver can
    2. Length of sliver remaining (calculated from the preset sliver length and roving delivery length)
    3. Predicted number of doff's before sliver change

Buttons

START button .... Touch this button at the start of sliver change.
END button .... Touch this button at the end of sliver change.

2) Sliver change procedure

At the time of sliver change, performing the sliver change START/END operation on the screen enables the sliver consumption prediction and sliver change warning.

Sliver change warning

- The sliver button turns red, prompting sliver change. (For setting up the sliver consumption prediction and sliver change warning, refer to Section 5.1.6. [3].)

At the start of sliver change

1. Touch the START button on the sliver consumption & sliver change info screen (Fig. 2), and the sliver change

block (setup) selection screen appears as shown in Fig. 3

2. Select the block (setup) whose sliver should be changed then touch the START button.
3. Make sure that the sliver change block is correctly selected and then proceed to sliver change jobs.

During sliver change job

- During a sliver change job, the screen shown in Fig. 4 is displayed. (The job time is counted.)
- The sliver button turns brown and shows the sliver change time

At the end of sliver change

- Touch the END button

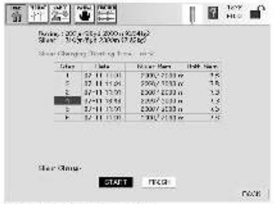


Fig. 4 During sliver change job

(8) Roving break input screen and roving break monitor screen

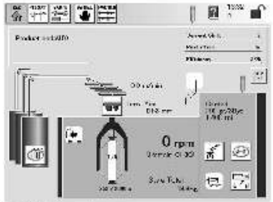


Fig. 1 Main (home) screen

Touching the roving break button* on the main (home) screen calls up the roving break input screen as shown in Fig. 2.

Roving break button

The roving break input screen allows entry of roving break info manually for each spindle.

NOTE: The roving break button can be displayed or hided on the User Setting screen.

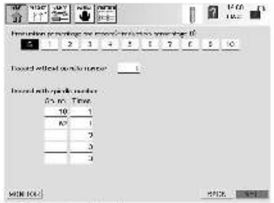


Fig. 2 Roving break input screen

1) Roving break input screen (Fig. 2)

   On the roving break input screen, enter roving break data for the corresponding spindle

   Entry items

   - Entry of roving breaks on a wound percentage basis

   NOTE: Usually no selection is required since this data is interlocked with the production percentage on the FL.

   - Entry of roving breaks that occurred on unknown spindles

NOTE: When spindle numbers are unknown, enter the number of roving breaks only to this field.

- Entry of spindle number and number of roving breaks

NOTE: Entering a spindle number to a spindle No. field automatically assign "1" to the roving breaks field.

NOTE: Roving break data for up to five spindles can be entered at the same time.

NOTE: Usually enter spindle numbers only and then touch the SET button.

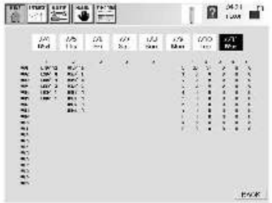


Fig. 3 Roving break monitor screen

2) Roving break monitor screen (Fig. 3)

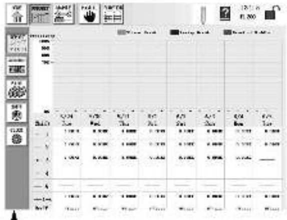
Touching the MONITOR button on the roving break input screen (Fig. 2) calls up the roving break monitor screen as shown in Fig. 3.

Display Items

The weekly data of the following items are displayed on a shift basis.

- 20 worst spindles that caused many roving breaks, and the number of roving breaks.
- Number of roving breaks for each of 11 types of production percentages

NOTE: Touching the BACK button returns to the roving break input screen (Fig. 2)



5.1.3 Production Information Display (Production mode)

[1] Sub Menu Configuration

Touching the [PRODUCT] button in the top menu calls up the sub menu vertically arranged at the left end of the screen.

REPORT	Touch this button to refer to the production length and operating rate on a shift basis in the past one week. (For the report screen, see 5.1.3 [2] later.)
COUNTER	Touch this button to refer to the production length and operating rate when manually changing the shift. (For the counter screen, see 5.1.3 [3] later.)
P.LOG	Touch this button to refer to the production log information for each roving condition. (For the production log screen, see 5.1.3 [4] later.)
SHIFT	Touch this button to make out a weekly shift schedule. (For the shift scheduling screen, see 5.1.3 [5] later.)
CLOCK	Touch this button to configure the system clock. (For the clock configuration screen, see 5.1.3 [6] later.)

Touching the PRODUCT button first displays the report screen. Touch the button of the desired item in the sub menu, and the related screen appears.

NOTE: If selected, the button turns orange.

To return to the main (home) screen, touch the HOME button in the top menu.

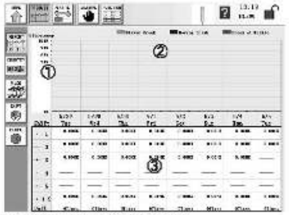


Fig. 1 Report screen (Operating rate)

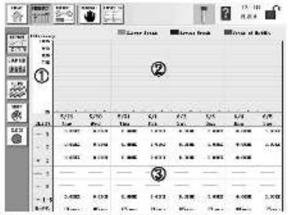


Fig. 2 Report screen (Stop motion count)

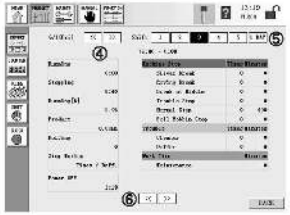


Fig. 3 Report detail screen

[2] Report

[2.1] Report screen

Touching the [PRODUCT] button in the top menu and the [REPORT] button in the sub menu calls up the report screen that shows the production information for the past one week.

① y-axis of operating rate transition graph

NOTE: See 5.1.3 [2.2] later for the graph configuration change.

② Operating rate transition graph (polygonal line graph)

- Operating rate graph
- Target line (dotted, red line)

NOTE: See 5.1.3 [2.2] later for the graph configuration change.

③ Production and operating rate per shift

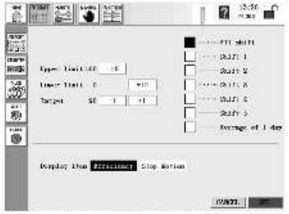
- If the actual record is below the target, it turns red. (The operating rate display can be switched to the stop motion count.)
- Touching a shift field calls up the report detail screen of that shift.

④ Date change switches on the report detail screen

- [<<] button: Switches back to the previous day's data.
- [>>] button: Switches to the next day's data.

⑤ Shift change switches on the report detail screen

- Shift [1]: Detail information is displayed for shift 1 of the day.
- Shift [2]: Displays the detailed info for shift 2 of the current date.
- Shift [3]: Displays the detailed info for shift 3 of the current date.
- Shift [4]: Displays the detailed info for shift 4 of the current date.
- Shift [5]: Displays the detailed info for shift 5 of the current date.
- [1 DAY]: Displays the detailed daily info of the current date.



Upper limit 100

Lower limit 0

Target 80

■ All shift

☐ Shift 1

☐ Shift 2

☐ Shift 3

☐ Shift 4

☐ Shift 5

☐ Average of 1 day

Display Item **Efficiency** Stop Motion

Fig. 4 Operating rate graph configuration change screen

⑮ Info change switches on the report detail screen

- [<<] button: Switches back to the previous shift's data.
- [>>] button: Switches to the next shifts data.

[2.2] Changing the operating rate graph configuration

Touching the y-axis area (⑪) on the report screen shown in Fig. 1 calls up the operating rate graph configuration change screen as shown in Fig. 4.
On this screen, the following items can be changed.

- Upper and lower limits of the operating rate graph (0 to 100% in units of 10%)
- Target operating rate (70 to 100% in units of 1%)
- Contents of graph to be displayed

[All shift]:	Plots the operating rates of all shifts.
[Shift 1]:	Plots the operating rates of shift 1 only.
[Shift 2]:	Plots the operating rates of shift 2 only.
[Shift 3]:	Plots the operating rates of shift 3 only.
[Shift 4]:	Plots the operating rates of shift 4 only.
[Shift 5]:	Plots the operating rates of shift 5 only.
[Average of 1 day]:	Plots the average of daily operating rates only.

NOTE: These graphs can coexist.

- Switching display items in shift fields between the operating rate and stop motion count

NOTE: For this switching, you need to turn the setting-enable (DATA SET) key to the DATA SET position beforehand.

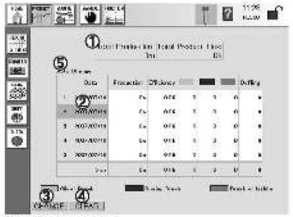


Fig. 1 Counter screen

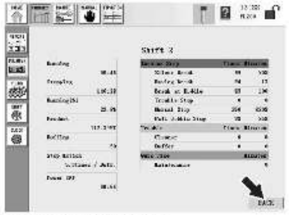


Fig. 2 Shift counter detail screen

[3] Counter

Touching the [PRODUCT] button in the top menu and the [COUNTER] button in the sub menu calls up the counter screen that shows the total production length (accumulation) delivered by the FL.

[3.1] Counter screen

① Total production length (accumulation)
Total production time (accumulated FL running time)

② Production length, operating rate (efficiency), stop motion count, and total doffing count on a shift basis

- The "Auto Change" or "Manual Change" is displayed above the table.
  (Refer to Section 5.1.3. [2].)
- The currently selected shift is displayed with dark blue background
- Date : Year/month/day when the counter resets itself and starts counting.
- Production : Total delivery length (HK or M)
- Operating rate (efficiency): FL running time percentage
- Sum : Shifts 1 through 5

③ Shift CHANGE button

④ Shift counter CLEAR button

⑤ Switching to the shift counter detail screen

- Touching the white margin in each shift counter field calls up the detail screen (Fig. 2) of the selected shift. To return to the previous screen, touch the BACK button.

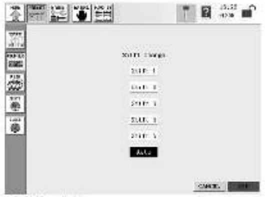


Fig. 3 Shift switching screen

[3.2] Totaling on a shift basis (Shift switching procedure)

(1) The following two types of totaling are available.

- Auto shift switching
  Selecting "Auto" automatically switch the shift counters that wok according to the setting made on the shift scheduling screen (see [5.1])
- Manual shift switching (max. 5 shifts)
  The worker manually switches the shift counters.

(2) To manually switch the shift counters, touch the CHANGE button (③ in Fig. 1), and the shift switching screen appears as shown in Fig. 3.
On this screen, touch the shift (out of "Shift 1" through "Shift 5") that is about to start, then touch the SET button to complete the shift switching procedure.
To automatically switch the shift counters, touch the Auto button on this screen.

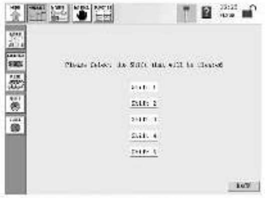


Fig. 4 Clear counter selection screen

[3.3] Clearing shift counters

(1) Touch the CLEAR button (④ in Fig. 1), and the clear counter selection screen appears as shown in Fig. 4.
On this screen, touch the shift counter (out of "Shift 1" through "Shift 5") to be cleared.

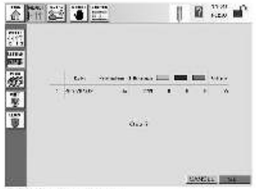


Fig. 5 Confirmation screen

(2) When the confirmation screen appears as shown in Fig. 5, check that the shift counter to be cleared is selected and then touch the SET button. (To cancel clearing, touch the CANCEL button.)

(3) The selected shift counter has been cleared to zero.

NOTE: If the shift counter is protected against accidental clearing on the misoperation protection screen called up by FUNCTION | User Setting | PROTECT (see Section 5.1.10, [4]), it is necessary to turn the setting-enable (DATA SET) key to the DATA SET position before the shift counter clearing procedure.

FUNCTION USER PROTECT

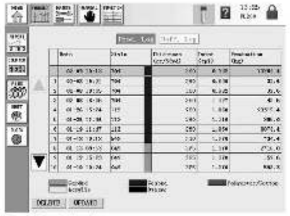


Fig. 1 Production log screen

[4] Production Log (P.LOG)

[4.1] Production log screen

Touching the [PRODUCT] button in the top menu and the [P.LOG] button in the sub menu calls up the production log screen that shows past 30 production records and past 50 doffing results.

PRODUCT P.LOG

Production log

Touch the Prod. Log button located at the upper section of the production log screen, and the production log list appears as shown in Fig. 1.

Changing the basic roving conditions such as material and twists per inch (tpi) automatically updates the production log.

Date: Roving start date (month-day hours minutes)

Style: Roving style (preset)

Material

Roving thickness (g/yard)

Twists per inch (tpi)

Total production (kg)

NOTE: The total production (kg) is calculated by converting the delivery length detected by the front roller rotation to the weight, using the average material in calculation in consideration of the number of spindles being used. It should be used as a reference value.

- The information under the current conditions is displayed at the top (dark blue background) of the table. As the number increases, the records get older.
- Ten records can be displayed in a single screen. To show older records, touch the ▼ button.

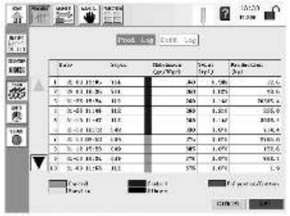
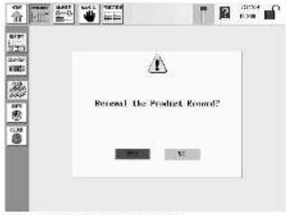


Fig. 2 Deletion selection screen



Renewal the Product Record?

Fig. 3 Updating confirmation screen

[4.2] Deleting a record made under certain conditions

(1) Turn the setting enable (DATA SET) key to the DATA SET position.

(2) Touch the DELETE button provided in the bottom left corner of the production log screen (Fig. 1) to call up the deletion selection screen as shown in Fig. 2.

(3) On this screen, touch the field of the record to be deleted, and the field becomes reversed to "white letters on black background." Check that the record is correctly selected, then touch the SET button.

(4) The record deletion procedure is completed. (One record can be deleted at a time.)
Turn the setting-enable (DATA SET) key to the previous position.

[4.3] Updating production log forcedly

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touch the UPDATE button provided in the bottom left corner of the production log screen (Fig. 1) to call up the updating confirmation screen as shown in Fig. 3.

(3) To update the production log, touch the YES button. It forcedly updates the log and clears the current conditions.

(4) The updating procedure is completed.
Turn the setting-enable (DATA SET) key to the previous position.

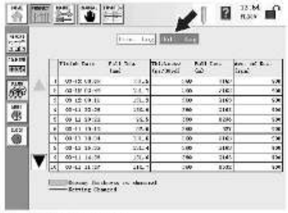


Fig. 4 Doffing log screen

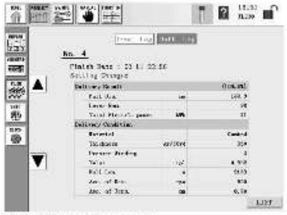


Fig. 5 Doffing log detail screen

[4.4] Doffing log screen

Touching the Doff. Log button on the production log screen.

- Calls up the doffing log screen that lists the currently stored doffing records.

Display items on the doffing log screen (Fig. 4)

Finish date: Doffing time (month-day hours:minutes)

Full bobbin diameter

Roving thickness (preset)

Full bobbin length (preset)

Flyer speed (preset)

Roving thickness abnormal: If any abnormality is found in the thickness of roving delivered, the field of the corresponding record turns red.

Setting changed: If changed, the setting is red-underlined.

- The last doffing record is displayed at the top (No. 1 line) of the table. As the number increases, the records get older.
- To show records older than the last 10 records, touch the ▼ button.
- Touching the white background section in the table calls up the corresponding doffing log detail screen as shown in Fig. 5.

Display items on the doffing log detail screen (Fig. 5)

Finish date: Doffing time (month-day hours:minutes)

Full bobbin diameter

Number of layers

Watt-hour

Material (preset)

Roving thickness (preset)

Presser winding (preset)

Twists per inch (preset)

Full bobbin length (preset)

Flyer speed (preset)

Target tension (preset)

Roving thickness abnormal: If any abnormality is found in the thickness of roving delivered, the thickness is displayed in red.

Setting changed: If changed, the setting is displayed in red.

[5] Shift

[5.1] Shift scheduling screen

Touching the [PRODUCT] button in the top menu and the [SHIFT] button in the sub menu calls up the shift scheduling screen on which you make up an automatic shift change schedule.
Automatic shift change scheduling is available in the following two modes.

- Simple scheduling: The shift change time is fixed every day.
- Detail scheduling: The number of shifts and the shift change time can be specifed arbitrary for each day of the week.

Up to five shifts can be specified.

Shift 1 applies to the current day.

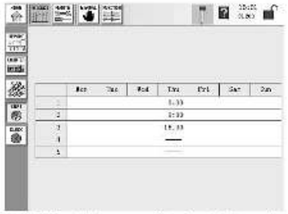


Fig. 1 Shift scheduling screen (Simple scheduling mode)

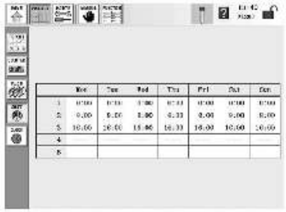


Fig. 2 Shift scheduling screen (Detail scheduling mode)

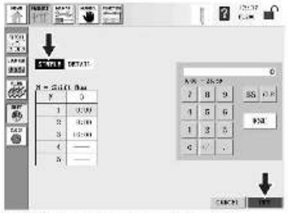


Fig. 3 Simple scheduling screen (during entry)

[5.2] Scheduling shifts in simple scheduling mode

The procedure given below schedules shifts in which the shift change time is fixed every day.

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) On the shift scheduling screen (Fig. 1 or Fig. 2), touch the field (white background) of the shift time to be changed.
In simple scheduling mode selected, the simple scheduling screen appears as shown in Fig. 3.
In detail scheduling mode selected, the detail scheduling screen appears as shown in Fig. 4.

(3) For simple scheduling, touch the SIMPLE button, and the button becomes reversed to "white letters on black background."

(4) Entering the shift number to access
Touch the shift number field (white background), and the numerical keypad appears.

(5) Specifying the shift change time

Touch the shift time field (white background), and the numerical keypad appears.

Example: To set 8.30

Touch 8, period (.), 3, 0, and ENT keys.

Tip:

- If the entered value is abnormal, the shift time indication turns red. Correct the value referring to the correlation with the overall time schedule.
(Accurate indication for abnormal entry is impossible.)
- If a new shift is added, the shift time field shows 99.99 in red by default. Set the desired time.

(6) Upon completion of all entries, touch the SET switch to complete the scheduling procedure.

(7) Turn the setting-enable (DATA SET) key to the previous position.

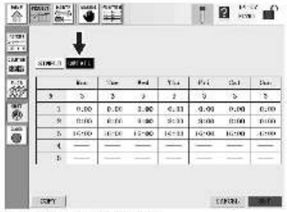


Fig. 4 Detail scheduling screen

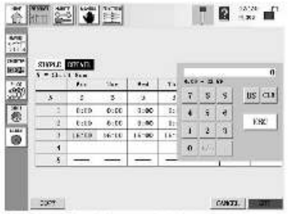


Fig. 5 Detail scheduling screen (during entry)

[5.3] Scheduling shifts in detail scheduling mode

The procedure given below schedules shifts in which the number of shifts and the shift change time can be specified arbitrary for each day of the week.

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) On the shift scheduling screen (Fig. 1 or Fig. 2), touch the field (white background) of the shift time to be changed.
In simple scheduling mode selected, the simple scheduling screen appears as shown in Fig. 3.
In detail scheduling mode selected, the detail scheduling screen appears as shown in Fig. 4.

(3) For detail scheduling, touch the DETAIL button, and the button becomes reversed to "white letters on black background."

(4) Entering the shift number to access for each day of the week
Touch the field (white background) of the shift number (any of 1 through 5) for each day of the week, and the numerical keypad appears.

Tip: The number of shifts can vary for each day of the week.

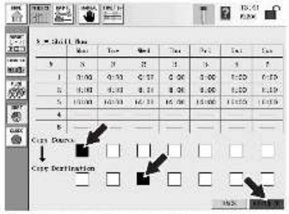


Fig. 6 Detail scheduling copy screen

(5) Specifying the shift change time for each day of the week

Touch the shift time field (white background) for the target shift, and the numerical keypad appears.

Example: To set 8:30

Touch 8, period (.) 3, 0, and ENT keys.

Tip:

- If the entered value is abnormal, the shift time indication turns red. Correct the value, referring to the correlation with the overall time schedule. (Accurate indication for abnormal entry is impossible.)
- -If a new shift is added, the shift time field shows 99.99 in red by default. Set the desired time.
- -To make the same setting for Monday through Thursday, for example, use the copy function. Touching the COPY button provided in the bottom left corner of the detail scheduling screen (Fig. 4) calls up the detail scheduling copy screen as shown in Fig. 6. As shown in Fig. 6, select the copy source and destination days of the week with the corresponding buttons (that turn from white and black), and then touch the EXECUTE button to complete copying. (Fig. 6 shows copying from the Monday setting to Wednesday one.)

(6) Upon completion of all entries, touch the SET switch to finish the scheduling procedure.

(7) Turn the setting-enable (DATA SET) key to the previous position.

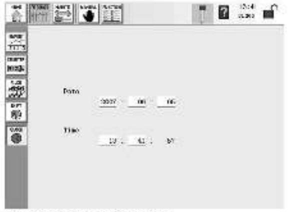


Fig. 1 Clock configuration screen

[6] Clock

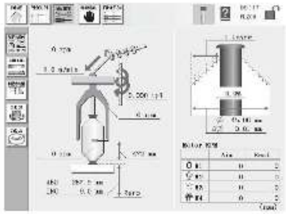
Touching the [PRODUCT] button in the top menu and the [CLOCK] button in the sub menu calls up the clock configuration screen on which you configure the system clock.

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touch the field of an item (year, month, day, hours, minutes, or seconds) to be changed, and the numerical keypad appears.

(3) Enter the desired value and touch the SET button in the bottom right corner of the screen.

(4) Turn the setting-enable (DATA SET) key to the DATA SET position.



5.1.4 Maintenance Information Display (Maintenance mode)

[1] Sub Menu Configuration

Touching the MAINTE button in the top menu calls up the sub menu vertically arranged at the left end of the screen.

MAINTE

SUB MONI

Touch this button to refer to the measured values including flyer speed and the rotation speed of motor shafts and the calculated values including the twists per inch and bobbin package data. (For the sub monitor screen, see 5.1.4 [2] later.)

24H LOG

Touch this button to refer to the FL running state for the last 24 hours and the stop motion occurrence states for the last five doffs. (For the 24H log screen, see 5.1.4 [3] later.)

MESSAGE

Touch this button to refer to the trouble log in the past. (For the message log screen, see 5.1.4 [4] later.)

CHECK

Touch this button to refer to the I/O monitor. (For the check screen, see 5.1.4 [5] later.)

CYCLE

Touch this button to specify the maintenance alarm items that are popped up on the main (home) screen at the specified intervals. (For the maintenance cycle screen, see 5.1.4 [6] later.)

Touching the MAINTE button first displays the sub monitor screen. Touch the button of the desired item in the sub menu, and the related screen appears.

NOTE: If selected, the button turns orange.

To return to the main (home) screen, touch the HOME button in the top menu.

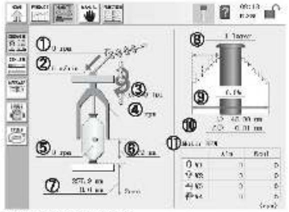


Fig. 1 Sub monitor screen

[2] Sub Monitor

Touching the MAINTE button in the top menu and the SUB MONI button in the sub menu calls up the sub monitor screen that shows the measured speeds and others (listed below) of the current operation in real time.

MAINTE
SUB MONI

Display items

- ① Front roller speed (rpm)
- ② Delivery speed
- ③ Twists per inch (tpi)
- ④ Flyer speed (rpm)
- ⑤ Winding speed (rpm)
- ⑥ Presser position (bottom margin reference)
- ⑦ Lifting encoder detection position (ABS and INC)
- ⑧ Current number of layers
- ⑨ Current wound percentage
- ⑩ ϕ (Current package diameter), Δ ϕ (Delta of package diameter)
- ⑪ Target and measured speeds (rpm) of motors

NOTE: The actually measured speeds of motors fluctuate because of short measurement intervals. These values should be referred to just as a guide for the running status.

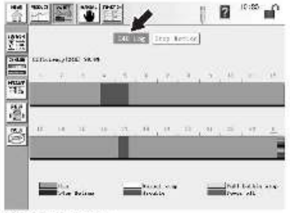


Fig. 1 24H log screen

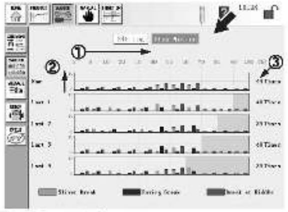


Fig. 2 Stop motion log screen

## [3] 24H Log

(1) Touching the MAINTE button in the top menu and the 24H LOG button in the sub menu calls up the 24H log screen that graphically shows the FL running state for the last 24 hours and the stop motion occurrence states on a wound percentage basis for the last five doffs.

MAINTE 24HLOG

For the definition of colors used in the 24H log graph, see the bottom of the screen.

NOTE: The 24H log screen provides the following auxiliary information.

- whether any abnormal stop or unexpected stop persisted for a period of time
- whether stop motions have frequently occurred

when the FL has been in operation or on halt.

(2) Stop motion log

Touching the Stop Motion button on the 24H log screen calls up the stop motion log screen that graphically shows the stop motion occurrence states on a wound percentage basis for a total of five doffs (current and last four doffs).

① x-axis ....Wound percentage (%) in 10% increments. "S" to "0" (%) means the winding start two layers.

② y-axis .....Number of stop motions that have occured. (Bar graph with the maximum scale value of 10 times)

NOTE: If the number of stop motions exceeds 10 times, it is expressed as 10.

NOTE: The definition of colors used in the stop motion log graph is as follows: Green (Sliver break), Blue (Roving break), and Red (Break at middle)

③ Total number of motion stops

Total number of sliver breaks, roving breaks, and breaks at middle in a single doff

NOTE: For the wound percentages of bobbins not being in production (e.g., doffed halfway), the background of the corresponding areas is gray.

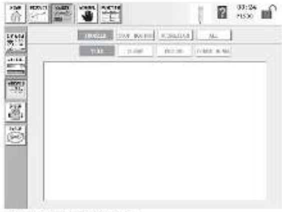


Fig. 1 Message log screen

[4] Message Log

Touching the MAINTE button in the top menu and the MESSAGE button in the sub menu calls up the message log screen that shows the trouble log and the operation log of the past.

MAINTE
MESSAGE

(1) Displaying the trouble log
Up to the past 100 records of troubles that have occurred in the past can be displayed.
Touch the TROUBLE log button to call up the trouble log screen.

The following three options are available for displaying the trouble log.

- "TIME"..................Arranges records from most to least recent.
- "COUNT"...............Arranges records in descending order of frequencies.
- "PERIOD"..............Shows the counting period of trouble messages currently displayed.
- "POWER DOWN"....Shows the graph of the PN voltage transition detected when the power failure has occurred.

Each trouble message is displayed in the format "Time when trouble occurred, Class, Code, Message content."

(2) Displaying the stop motion log
Up to the past 100 records of stop motions that have occurred in the past can be displayed.
Touch the STOP MOTION log button to call up the trouble log screen.

The following two options are available for displaying the trouble log.

- "TIME"..................Arranges records from most to least recent.
- "PERIOD"..............Shows the counting period of stop motion messages currently displayed.

Each trouble message is displayed in the format "Time when trouble occurred, Class, Code, Message content."

(3) Displaying the operation log
Up to the past 100 records of operation motions that have occurred in the past can be displayed.
Touch the OPERATION log button to call up the operation log screen.

Each operation is displayed in the format "Time when the operation was performed, Class, Code, Operation content."

(4) Displaying all logs
All message records of the trouble log and operation log can be displayed, from least to most recent.
Touch the ALL log button to display all logs.

(5) Touching the POWER DOWN button graphically shows the voltage change of the main inverter immediately before the power failure has occurred.

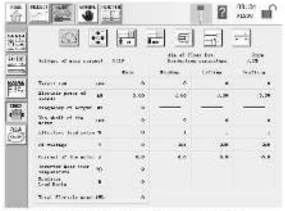


Fig. 1 Running info on the FL drive mechanisms

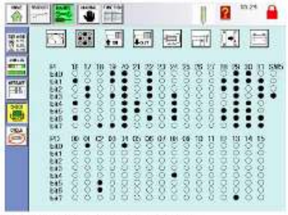


Fig. 2 I/O monitor with a bitwise matrix

[5] Check

Touching the MAINTE button in the top menu and the CHECK button in the sub menu calls up the check screen that shows the running information on the FL drive mechanisms and the I/O monitor, as well as providing the battery check function.
This check screen is used for troubleshooting.

MAINTE
CHECK

(1) Displaying the running information of the drive mechanisms (Fig. 1)

Touch this button provided at the top of the screen.

This screen shows the target speeds and other data of the main, winding, lifting, and drafting motors and the basic information of the inverter and servo amplifiers.

(2) Displaying the I/O monitor with a bitwise matrix (Fig. 2)

Touch this button provided at the top of the screen.

This screen allows you to monitor the status of all input and output signals.

○ : OFF, ● : ON

Input signals are assigned to PI16 through PI31 (bit 0 through bit 7 for each) and DIP SW5 of the CPU board.
Output signals are assigned to PO00 through PO15 (bit 0 through bit 7 for each).For the I/O signal functions, refer to the instrumentation drawings.

Example: Start switch on the FL

START PB (PI17P4), where PI17 means input 17 and P4 means bit 4.

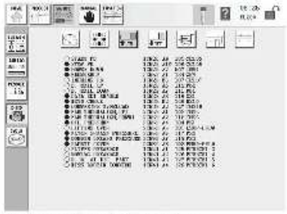


Fig. 3 I/O monitor for individual devices

(3) Displaying the I/O monitor for individual devices (Fig. 3)

The typical input and output signals are classified into five groups according to devices as shown with the following five buttons.

Touch the desired group button. Components in each group are listed with their names and related data as shown below.

FL input signals

FL output signals

Inverters and amplifiers related input/output signals

Cleaner related signals

FRD related signals (only for FLs equipped with FRD)

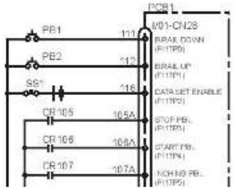
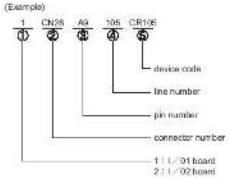
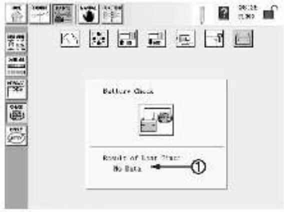

PCB1
I/01-CN28
PB1
111
B.RAIL DOWN
(F117P0)
PB2
112
B.RAIL UP
(F117P1)
SS1
116
DATA SET ENABLE
(F117P2)
CR105
105A
STOP PBL
(F117P3)
CR106
106A
START PBL
(F117P4)
CR107
107A
INCHING PBL
(F117P5)

Fig. 4 Circuit diagram


(Example)
1
CN28
A9
105
CR106
①
②
③
④
⑤
device code
line number
pin number
connector number
1 : I／01 board
2 : I／02 board

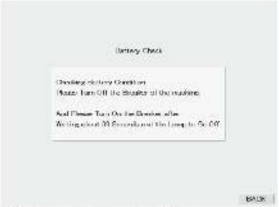


Battery Check

Results of Last Check

No Data

Fig. 5 Battery check screen



Battery Check

Checking Battery Condition

Please Turn Off the Breaker of the machine

And Please Turn On the Breaker after

Waiting about 30 Seconds and the Lamp to Go Off

Fig. 6 Battery check prompting window
(Wait with power being OFF)

(4) Battery check function (Fig. 5)

Touch this button provided at the top of the screen.

To assure the control power when a power failure occurs, the FL has a backup battery in the control box. The battery check function checks the power of the backup battery.

1) When the FL is on halt, touch the battery check button.

Battery check button

2) Wait for the battery check prompting window (Fig. 6) to appear.
With this window being displayed, turn the circuit breaker OFF.

3) Wait approx. 30 seconds. Check that the signal indicator (tower lamp) is OFF, and then turn the circuit breaker ON.

4) If the battery power is sufficient, the pop-up message "Battery Normal" appears.

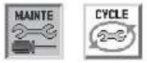
If it is insufficient, the warning message appears.

5) The result of the last battery check is displayed on the battery check screen [① in Fig. 5].
(For details, refer to Section 7.1.3. [23].)

[6] Maintenance Alarm Setting

(1) Displaying the maintenance alarm setting screen

Touching the MAINTE button in the top menu and the CYCLE button in the sub menu calls up the maintenance alarm setting screen that enables you to specify the maintenance alarm items to be popped up cyclically on the main (home) screen.



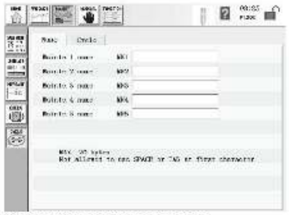


Fig. 1 Maintenance alarm naming screen

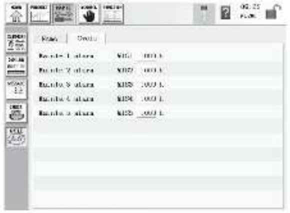


Fig. 2 Display interval screen

(2) Specifying the maintenance alarm items and its pop-up intervals

1) Turn the setting-enable (DATA SET) key to the DATA SET position.

2) Touch the Name tab to call up the maintenance alarm naming screen (Fig. 1).

3) Touch the name entry field, and the keypad appears.

4) Enter the desired maintenance name.

5) Touch the Cycle tab to call up the display interval screen (Fig. 2).

6) Touch the interval entry field having the same maintenance number as the name entered, and the keypad appears. Enter the pop-up intervals.

7) Touch the SET button to establish the new setting. Turn the setting-enable (DATA SET) key to the previous position.

NOTE: If the name entry field contains any letters, the pop-up alarm message appears cyclically on the main (home) screen. To cancel the pop-up alarm, delete the maintenance alarm name from the entry field.

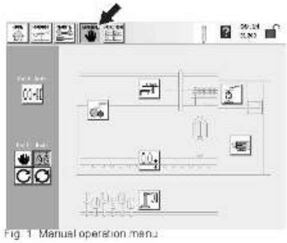


Fig. 1 Manual operation menu

5.1.5 Manual Operation Display (Manual mode)

[1] Manual Operation Menu

- Touching the MANUAL button in the top menu calls up the manual operation menu (Fig. 1).

MANUAL button

■ **Description of buttons**

- Half Doff button

  Touch this button when performing halfway doffing
  (Refer to [9].)

- Doff Mode buttons
  Touch these buttons to switch between the operation modes for full-bobbin doffing.

  - Manual mode button
    Stops the FL in the full-bobbin position. Pressing the bobbin rail-down switch starts doffing.
  - Over-down mode button
    Automatically moves the bobbin rail down to the over-down position (doffing position) after a full-bobbin stop.
  - Semi-auto mode button (available only when the FL is equipped with an FRD)
    Automatically performs doffing with the FRD after a full-bobbin stop. Restarting should be triggered manually.
  - Full-auto mode button (available only when the FL is equipped with an FRD)
    Automatically performs doffing with the FRD and restarting after a full-bobbin stop.

- Greasing button

  Touch this button to manually grease the flyer and bobbin mechanisms. (Refer to [5].)

- Cleaner button

  Touch this button to drive the CWC unit and the blow cleaner. (Refer to [2] and [3].)

- Manual bobbin rail button

  Touch this button to perform manual bobbin rail operation. Unlike the bobbin rail-up and -down switches, the manual bobbin rail operation moves the bobbin rail by the specified traveling distance. (Refer to [4].)

- Roving button

  Touch this button to perform the fleece assist operation or the roving loosening operation at the start of roving. (Refer to [6] and [7].)

- Motor button

  Touch this button to drive the flyer, winding, drafting, and bobbin rail motors individually. (Refer to [8].)

- FRD button (available only when the FL is equipped with FRD)

  Touch this button to perform the FRD related operations and display their info.

- Each of these manual operations stated above can be protected with the setting-enable (DATA SET) key against accidental triggering. (Refer to Section 5.1.10, [4].)

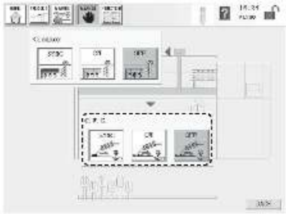


Fig. 1 Cleaning device operation screen

[2] CWC Operation

- Touching the cleaner button on the manual operation menu calls up the cleaning device operation screen.

Cleaner button

On the cleaning device operation screen, touch one of the following buttons to select the CWC drive mode. If selected, the drive mode button turns green.

Interlock mode
in which the CWC unit works, interlocking with the FL.

Forced ON mode
in which the CWC unit always works independent of the FL operation

Forced OFF mode
in which the CWC unit always stops independent of the FL operation.

- For details of the CWC operation and settings, refer to Chapter 7. Section 7.1.3. [9].

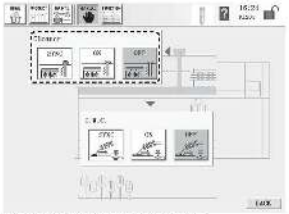


Fig. 1 Cleaning device operation screen

[3] Blow Cleaner Operation

- Touching the cleaner button on the manual operation menu calls up the cleaning device operation screen.

Cleaner button

On the cleaning device operation screen, touch one of the following buttons to select the cleaner drive mode. If selected, the drive mode button turns green.

Interlock mode
in which the blow cleaner works, interlocking with the FL.

Forced ON mode
in which the blow cleaner always works independent of the FL operation.

Forced OFF mode
in which the blow cleaner always stops independent of the FL operation.

- For details of the blow cleaner operation and settings, refer to Chapter 7, Section 7.1.3, [10].

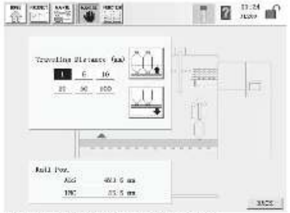


Fig. 1 Manual bobbin rail operation screen

[4] Manual Bobbin Rail Operation

- Touching the manual bobbin rail button on the manual operation menu calls up the manual bobbin rail operation screen.

  Manual bobbin rail button

Using the buttons on this screen can move the bobbin rail up and down by the specified traveling distance, unlike the bobbin rail-up and -down switches.

NOTE:

Operating procedure

(1) Turn the setting-enable (DATA SET) key to the DATA SET position (green ● position).

(2) Touch the desired traveling distance button (1, 5, 10, 20, 50, or 100 mm), and the selected button becomes reversed to "white letters on black background."

(3) Touch the desired traveling direction button (UP or DOWN), and the bobbin rail moves in the specified direction by the specified distance.

Bobbin rail UP button
Moves the bobbin rail up by the specified traveling distance.

Bobbin rail DOWN button
Moves the bobbin rail down by the specified traveling distance.

- During bobbin rail movement, monitor the bobbin rail to prevent interference or collision with the machines or bobbins and check for any abnormal noise. In an emergency, press the emergency stop switch to immediately stop the FL.
- For details of the bobbin rail operation, refer to Chapter 7, Section 7.1.3, [21].

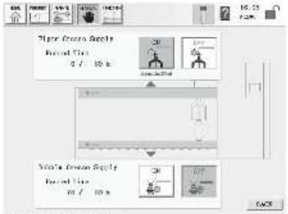
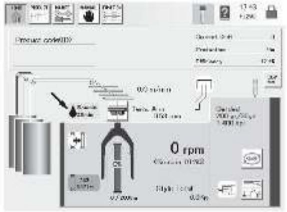


Fig. 1 Greasing screen



[5] Greasing

- Touching the greasing button on the manual operation menu calls up the greasing screen as shown in Fig. 1

  Greasing button

  Usually automatic greasing is performed at the specified intervals. Using the buttons on this screen allows manual greasing.

(1) Greasing the flyer gears

Touch this button to start greasing operation. When greasing is completed, it automatically turns off.

Touch this button to forcedly stop greasing halfway through greasing operation.

(2) Greasing the bobbin gears

Touch this button to start greasing operation. When greasing is completed, it automatically turns off.

Touch this button to forcedly stop greasing halfway through greasing operation.

- The greasing screen (Fig. 1) shows the monitored values--"Elapsed time since the last greasing"/"Automatic greasing intervals (preset)."
- When greasing operation is in progress, the remaining time before the completion of greasing is displayed under the greasing ON button. The remaining time is also displayed in red on the main (home) screen as shown below.

  Remain
  28min

- For details of the greasing operation and settings, refer to Chapter 7, Section 7.1.3, [12].

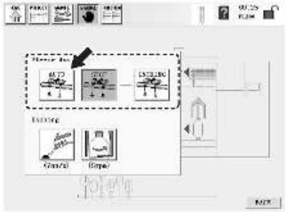


Fig. 1 Roving assist screen

[6] Fleece Feeding Operation (Roving Assist Function)

- Touching the roving button on the manual operation menu calls up the roving assist screen (Fig. 1) that assists preparation for roving. After feeding roving (fleece) out of the draft part, touching the buttons on this screen assists fleece in threading through flyers.

Roving button

NOTE: Before using this roving assist function, it is necessary to pass fleece through the draft part for all spindles. Do not use this function during ordinary roving operation.

Operating procedure

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touch the AUTO button, and the confirmation screen appears.

(3) Touch Yes, and fleece is automatically fed by the specified length and stopped.
(The fleece length can be changed on the screen called up by selecting FUNCTION | INIT | OTHER.)

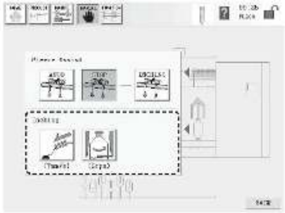
Buttons on the roving assist screen

Touch this button once to feed fleece by the specified fleece length. (When feeding operation is in progress, this button is in green.)

Touch this button to forcedly stop feeding fleece halfway. (When feeding is stopped, this button is in green.)

While this button is touched, fleece is delivered. (This is used for line adjustment.)

- For details of the fleece feeding operation and settings, refer to Chapter 7, Section 7.1.3, [17].



[7] Manual Roving Loosening Operation

- Touching the roving button on the manual operation menu calls up the roving assist screen that allows the worker to loosen roving manually during roving operation.

NOTE: Turn the setting-enable (DATA SET) key to the DATA SET position and use the following buttons.

Buttons on the roving assist screen

AUTO	Draft forward inching button While this button is touched, the drafting motor rotates in the roving feeding direction. *Delivery speed: Approx. 7 mm/s
STOP	Bobbin reverse inching button While this button is touched, the bobbins rotate in the reverse direction. *Bobbin rotation speed: Approx. 5 rpm

NOTE: Carefully use these buttons. Carelessly using them may result in an operational problem.

- For details of the manual roving loosening operation and settings, refer to Chapter 7, Section 7.1.3, [20].

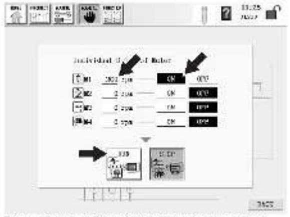


Fig. 1 "Individual Drive of Motor" screen (for setting)

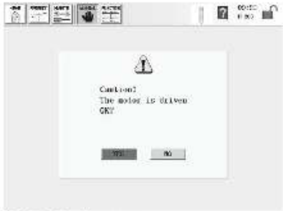

Caution!
The motor is driven
OK?

Fig. 2 Confirmation screen

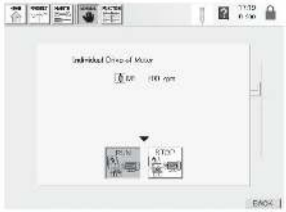

Individual Drive of Motor

Fig. 3 "Individual Drive of Motor" screen (in progress)

[8] Individual Motor Drive Operation

- Touching the motor button on the manual operation menu calls up the "Individual Drive of Motor" screen on which the worker can drive the main, winding, lifting, and drafting motors individually. This individual motor drive operation is useful in maintenance and inspection jobs.

  NOTE: Before performing individual motor drive operation, confirm that there are no workers or obstacles in the surrounding area for safety.

  - When roving operation is in progress, do not perform this operation.

Operating procedure

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Enter the desired speed to the rpm field of the target motor to be driven.

(3) Touch the ON button of the target motor. (Other motors not to be driven should be OFF.)

(4) Touch the RUN button, and the confirmation screen (Fig. 2) appears.

(5) Check for safety again and then touch YES to start driving the target motor.

RUN button

(6) When the individual motor drive operation is in progress, the screen shown in Fig. 3 is displayed. This screen shows the preset rotation speed (rpm) of the motor being driven.
The RUN button is in green.

(7) To stop the motor, touch the STOP button.
The screen returns to the one shown in Fig. 1.

STOP button

- Pressing the Stop switch in a set of three push-button switches also stops the motor.

- For details of the individual motor drive operation and settings, refer to Chapter 7, Section 7.1.3, [22].

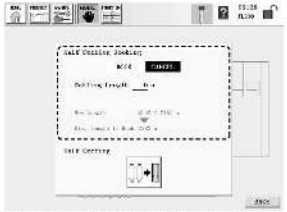


Fig. 1 Half Doffing Booking & Half Doffing window

[9] Halfway Doffing Operation

- Touching the Half Doffing button on the manual operation menu calls up the Half Doffing Booking & Half Doffing window that allows the worker to book halfway doffing with the specified length less than the preset full-bobbin length or to forcedly start halfway doffing.

Halfway doffing button

[9.1] Booking halfway doffing

The following procedure books the specified length less than the preset full-bobbin length to cause a full-bobbin operation for the current doffing.

Booking procedure

(1) Touch the Doffing Length field and enter the desired delivery length.

(2) Touch the BOOK button to reverse it to "white letters on black background." This completes booking.

- When the actual delivery length reaches the preset doffing length, a full-bobbin operation starts.
- The doffing length should be greater than the "Min. length to book" shown on the screen.
- To cancel booking, touch the CANCEL button to reverse it to "white letters on black background."

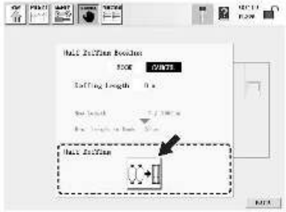


Fig. 2 Half Doffing Booking & Half Doffing window

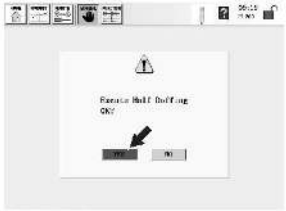

Execute Half Doffing OK?

Fig. 3 Confirmation screen

[9.2] Starting forced halfway doffing

The following procedure forcedly causes a full-bobbin stop when the bobbin rail reaches the full-bobbin stop position first after the procedure.

Operating procedure
Touching the Half Doffing button on the Half Doffing Booking & Half Doffing window calls up the confirmation screen shown in Fig. 3.

On the confirmation, touching YES starts halfway doffing.

- For details of the halfway doffing operation, refer to Chapter 7. Section 7.1.3. [18]

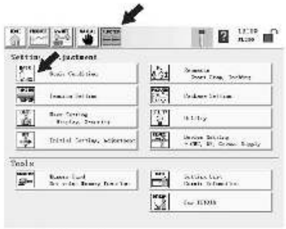


Fig. 1 Function menu

5.1.6 Setting up Roving Delivery Conditions (FUNCTION | BASIC)

[1] Sub Menu Configuration

- Touching the FUNCTION button in the top menu and the BASIC button in the function menu (Fig. 1) calls up the "Basic Condition" window (Fig. 2).

FUNCTION BASIC

The sub menu containing the following buttons is also displayed vertically at the left end of the screen (Fig. 2)

ROVING Roving conditions button
Touch this button to set up the basic conditions of roving to be delivered, such as material, thickness (weight), and the number of twists. (Refer to [2] later.)

SLIVER Sliver button
Touch this button to set the sliver name, length, and sliver change warning. (Refer to [3] later.)

MECHA Mechanical adjustment button
Touch this button to change mechanical adjustment values such as TDC (total draft change gear), BDC (brake draft change gear), and tenser gauge. (Refer to [4] later.)

MONI Production data button
Touch this button to set the number of spindles to be used for production, which is used to calculate the total production amount.

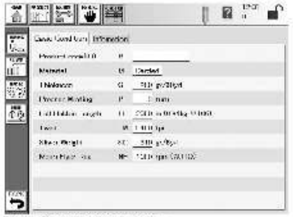


Fig. 1 "Basic Condition" window

[2] Setting up of Roving Conditions

The items shown on this screen (called up by the ROVING button) are important conditions that are requisite for running the FL. If any roving conditions different from the actual ones are entered, the FL malfunctions. Make the following settings without mistakes.

Roving conditions to be set

(1) Product code
Up to 10 alphanumeric characters can be entered.

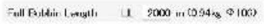
(2) Material
The fiber material is selectable from Carded, Combed, P/C, Acrylic, and others.

(3) Thickness
Enter the thickness (weight) of roving to be delivered.
The unit is selectable from "gr/30yd," "g/m," "Ne," and "Nm." (Refer to Section 5.1.10 "User Settings," [2].)

(4) Presser Winding
Enter the number of windings of roving around the presser. (Entry range: 2 to 4)

(5) Full bobbin length
The unit is selectable from "m" and "yd." (Refer to Section 5.1.10, "User Settings," [2].)

NOTE: At the right side of the full bobbin length field, the value converted to kg and the predicted full bobbin diameter are displayed as a guide.



Full Bobbin Length LL 2000 m (0.94kg Φ100)

(6) Number of twists
The unit is selectable from "twists per inch (tpi)" and "twists per meter (tpm)." (Refer to Section 5.1.10, "User Settings," [2].)

(7) Sliver weight
Enter the weight of sliver to feed.
The unit is selectable from "gr/6yrd," "g/m," "Ne," and "Nm."

(8) Flyer speed change pattern

- The FL provides the AUTO mode in which entering only the mean flyer speed (rpm) automatically determines the flyer speed change pattern that will not cause roving breaks easily.
- An arbitrary flyer speed change pattern can also be specified manually on a wound percentage basis (increments of 10%).

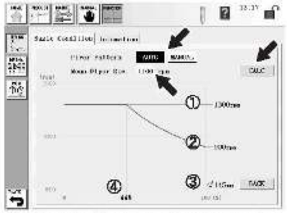


Fig. 2 "Basic Condition" window, for setting up the flyer speed change pattern in AUTO mode

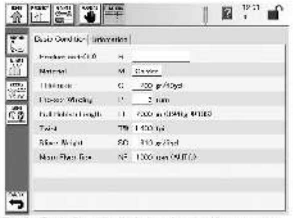


Fig. 3 "Basic Condition" window, for checking the new settings

Setting up the flyer speed change pattern in AUTO mode

(1) On the "Basic Condition" window (Fig. 1), touch the "Mean Flyer Rev. NF" entry field, and the flyer speed change pattern setting screen (Fig. 2) appears.
On this screen, touch the AUTO" button.

Choice of the flyer speed change mode

AUTO: Determines the speed change curve automatically according to the roving delivery conditions and the preset mean flyer speed (rpm). (Recommended mode)

MANUAL: Allows you to arbitrarily specify the flyer speed for each wound percentage (at 11 stages).

(2) Enter the mean flyer speed (rpm).

(3) With the speed change mode selected in step (1), touch the CALC button, and the following data are automatically calculated and displayed graphically on the screen as shown in Fig. 2.

1 Initial flyer speed (rpm)

2 Flyer speed at the predicted full-bobbin diameter

3 Predicted full-bobbin diameter

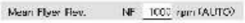
4 Wound percentage at the start of speed change

NOTE: If no data appears on the graph, it means that any setting is abnormal. Review the mean flyer speed preset and full-bobbin length.

NOTE: The predicted full-bobbin diameter should be used as a guide for roving operation. (Allowable maximum setting: 150 mm for 6-inch version, 180 mm for 7-inch version)

(4) Touch the BACK button, and the screen returns to the "Basic Condition" window.

(5) The "Basic Condition" window shows the mean flyer speed (rpm) followed by the (flyer speed change mode). To establish the data, touch the SET button.



Mean Flyer Rev. NF 1000 rpm (AUTO)

NOTE: Flyer speed change pattern in MANUAL mode

Specify the Δ ϕ (Delta of package diameter) at 11 stages on a wound percentage basis, using the cop-related setter. For the operating procedure, refer to Section 5.1.2 [2.4.2].

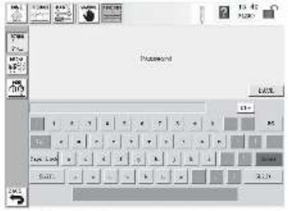


Fig. 4 "Basic Condition" window, for entering password

Password protection of roving conditions against accidental change

The roving conditions preset can be password-protected against accidental change. (For the password protection procedure, refer to Section 5.1.10 "User Setting," [4].)

If they are password-protected, attempting to change the roving conditions (when the SET button is touched) calls up the password entry window.

Without entry of the registered password on this window, any change cannot be accepted.

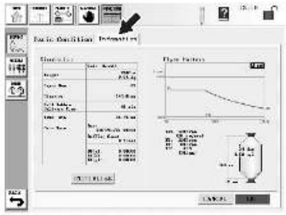


Fig. 5 "Basic Condition" window, for monitoring data preset

Information display

Touch the Information tab on the "Basic Condition" window, and the preset roving conditions and calculated simulation data appear as listed below (Fig. 5).

- Weight
- Number of layers (calculated)
- Full-bobbin diameter (calculated)
- Flyer speed change pattern
- Average target tension
- Shape of bobbin package (Lift, shoulder angle, number of layers, and winding margin)
- Parameter values in the production result database

NOTE: About the INITIALIZE button

The FL optimizes the running conditions each time the roving sequence is completed and applies them (production result database) to the next roving sequence. To initialize the related information, touch the INITIALIZE button.

Never touch this button when the roving operation is in progress.

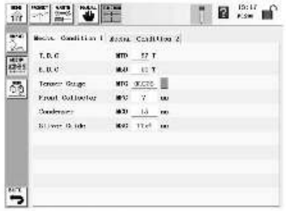

Mecha. Condition 1
Mecha. Condition 2
T.D.C
B.D.C
Tensor Gauge
Front Collector
Condenser
Sliver Guide

Fig. 1 Sliver configuration screen

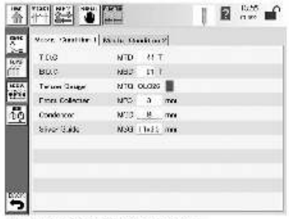

Mecha. Condition 1
Mecha. Condition 2
T.D.C
B.D.C
Tensor Gauge
Front Collector
Condenser
Sliver Guide

Fig. 2 Mechanical adjustment screen 1

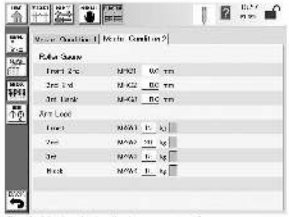

Mecha. Condition 1
Mecha. Condition 2
Roller Gauge
Front-2nd
2nd-3rd
3rd-Back
Arm Load
Front
2nd
3rd
Back

Fig. 3 Mechanical adjustment screen 2

[3] Sliver Settings

The sliver configuration screen (called up by the SLIVER button and shown in Fig. 1) allows you to make the sliver settings that are used for sliver consumption prediction and sliver change warning to be displayed on the sliver consumption & sliver change info screen of the main (home) screen.

Entry items

- Sliver to be used
- Sliver length
- Sliver change warning ON/OFF
- Number of sliver change setups

NOTE: The thickness (weight) of sliver should be specified on the "Basic Condition" window shown in [2] earlier.

NOTE: For details of the sliver consumption & sliver change info screen, refer to Section 5.1.2. [2.5], (7).

[4] Entry of Mechanical Adjustment Values

The mechanical adjustment screens (called up by the MECHA button and shown in Figs. 2 and 3) allow you to configure the following items for managing the mechanical adjustment values in conjunction with the roving conditions.

Entry items

- Total draft change gear (T.D.C.)
- Brake draft change gear (B.D.C.)
- Tensor gauge
- Front collector
- Sliver guide
- Roller gauges
- Arm loads

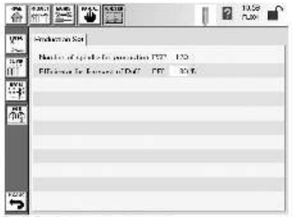


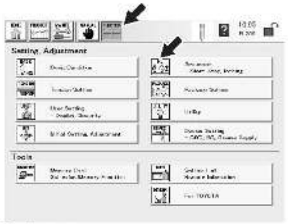
Fig. 1 Production data entry screen

[5] Production Data Entry

The production data entry screen (called up by the MONI button and shown in Fig. 1) allows you to enter the following items.

Entry items

- Number of spindles for production (PSP)
  This data is used for calculating the production volume. Change the value when some spindles are lacking.
- Efficiency for forecast of doffing (PEf)
  This data is used for calculating the doffing forecast time. (It is provided for TMS (option).)

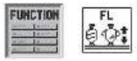


Function menu

5.1.7 Start/Stop Related Settings

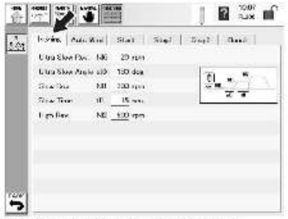
Calling up the sequence setting screen

- Touching the FUNCTION button in the top menu and the FL button in the function menu (shown at left) calls up the sequence setting screen (inching) shown in Fig. 1.



The sequence setting screen consists of the following pages that can be opened by touching the corresponding tab.

- Inching (Fig. 1)
- Automatic winding (Fig. 2)
- Start (Fig. 3)
- Stop 1 (Fig. 4)
- Stop 2 (Fig. 5)
- Bunch winding (Fig. 6) (Available only when the FL has the bunch winding function.)



Ultra Slow Rev. NI0 20 rpm

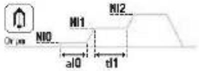
Ultra Slow Angle aI0 180 deg

Slow Rev. NI1 300 rpm

Slow Time tI1 15 sec

High Rev. NI2 600 rpm

Fig. 1 Sequence setting screen (Inching page)



[1] Inching

Touching the Inching tab on the sequence setting screen calls up the inching page (Fig. 1) on which you specify the inching operation.

Operation sequence

(1) Pressing the Inching button drives the FL at ultra slow speed (NI0).

(2) After the flyer rotates by the ultra slow angle (aI0), the FL accelerates up to the slow speed (NI1).

(3) After the FL keeps inching at slow speed (NI1) for the slow time (tI1), it accelerates up to the high speed (NI2).

(4) Releasing the Inching button decelerates the FL to a stop.

NOTE: For details, refer to Chapter 7, Section 7.1.3, [2].

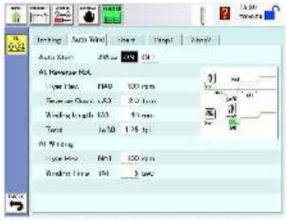
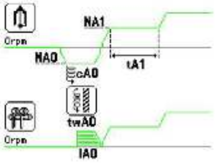


Fig. 2 Sequence setting screen (Automatic winding page)



[2] Automatic Winding

Touching the Auto Wind tab on the sequence setting screen calls up the automatic winding page (Fig. 2) on which you specify the automatic winding operation.

The automatic winding operation enables the smooth winding of roving at the start of roving operation after doffing.

Operation sequence

(1) At the winding start position after doffing, pressing the Start button starts automatic winding operation.

(2) In a state where spinning has been stopped, only the flyer rotates in the opposite direction of normal spinning at according to the winding rpm (NA0) and the number of reverse turns (cA0). (Movement to the inside of the presser is made.)

(3) The FL starts roving to deliver roving by the specified winding length (lA0) during the flyer reverse rotation. (This advances roving to wind around the special cloth on bobbins.)

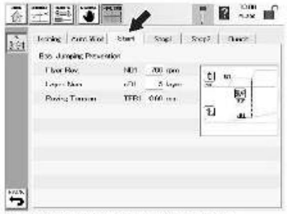
- The spinning speed at this time is adjusted according to the number of twists per inch (twA0) in reverse rotation.

(4) The FL stops operation once and then starts ordinary operation with the flyer rotating in the forward direction.

(5) The flyer accelerates up to the automatic winding speed (NA1). After the specified winding time (tA1) has elapsed, the flyer speed further accelerates up to the target one so that the FL performs ordinary operation.

NOTE: For details, refer to Chapter 7, Section 7.1.3. [8].

- To skip the flyer reverse rotation performed in steps (2) and (3) above, select OFF for Auto Start (Awsw).



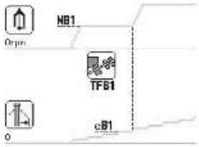
Bob. Jumping Prevention

Flyer Rev. NB1 700 rpm

Layer Num. cB1 5 layer

Roving Tension TFB1 0.00

Fig. 3 Sequence setting screen (Startup page)



[3] Prevention of Bobbin Jumping (Start)

Touching the Start tab on the sequence setting screen calls up the startup page (Fig. 3) on which you specify the prevention of bobbin jumping.

The bobbin jumping prevention applies only to the specified number of layers at the start of winding in order to prevent bobbins from jumping up temporarily by roving at the reverse time around lower shoulders during high-speed or high-tension roving operation.

Operation sequence

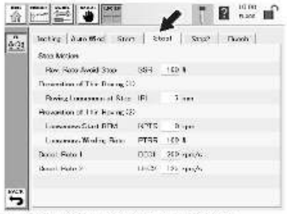
(1) Upon completion of automatic winding after doffing, the flyer speed accelerates up to the bobbin jumping prevention speed (NB1).

(2) After the specified number of layers (cB1) is produced, the flyer speed further accelerates up to the target one so that the FL performs ordinary operation.

(3) When the FL is running at the bobbin jumping prevention speed (NB1), the roving tension (TFB1) specified for bobbin jumping prevention applies.

NOTE: For details, refer to Chapter 7, Section 7.1.3, [7].

- To disable bobbin jumping prevention, enter "0" to the number of layers (cB1).
- The bobbin jumping prevention speed (NB1) is lower than the regular speed, so roving is likely to be loosely wound. To avoid loose wound, specify higher tension (TFB1) than usual target tension while monitoring the delivery state.



Stop Motion
Rev. Rate Avoid Stop SSR 100 %
Prevention of Thin Roving (1)
Roving Looseness at Stop IRL 3 mm
Prevention of Thin Roving (2)
Looseness Start RPM NPTR 0 rpm
Looseness Winding Rate PTRR 100 %
Decel. Rate 1 DEC1 200 rpm/s
Decel. Rate 2 DEC2 150 rpm/s

Fig. 4 Sequence setting screen (Stop 1 page)

[4] Normal Stop and Stop Motion (Stop 1)

Touching the Stop 1 tab on the sequence setting screen calls up the Stop 1 page (Fig. 4) on which you specify stop motion operation.

Entry items

- Stop Motion "Rev. Rate Avoid Stop" (SSR)
  The SSR specifies the lower limit of the flyer speed, as a ratio of the ordinary flyer speed, which applies during deceleration to a stop or in the bobbin rail reversing position when a stop motion is triggered. This avoids the bobbin rail from stopping in the shoulder of bobbins or from reversing at extremely low flyer speed, preventing roving from coming off the shoulder of bobbins. (Refer to Chapter 7, Section 7.1.3, [4].)

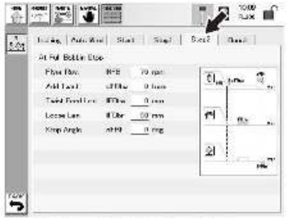
- Prevention of Thin Roving (1), for the stop time (IRL)
  To prevent thin roving irregularity from being generated when the FL stops, the FL loosens roving by feeding extra roving specified by the "Roving Looseness at Stop" (IRL). (Refer to Chapter 7, Section 7.1.3, [1].)

- Prevention of Thin Roving (2), for the deceleration time (NPTR and PTRR)
  During deceleration, after the main motor speed decreases below the "Looseness Start RPM" (NPTR), the winding motor speed decreases by the "Looseness Winding Rate" (PTRR) in order to produce roving looseness. (Use this function when the prevention of thin roving (1) above is insufficient.)

  NOTE: Setting the "Looseness Start RPM" (NPTR) to "0" disables this function. (Refer to Chapter 7, Section 7.1.3, [1].)

- Decel. Rates (DEC1 and DEC2)
  These items specify the flyer deceleration rate during deceleration to a stop.
  The DEC1 specifies the flyer deceleration rate that applies when the regenerative discharge resistor circuit is normal.
  The DEC2 specifies the flyer deceleration rate that applies when the regenerative discharge resistor circuit is abnormal.

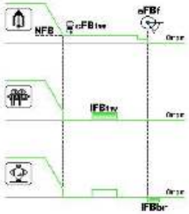
  NOTE: Increasing the deceleration rate excessively will result in FL trouble.



At Full Bobbin Stop

Flyer Rev. NFB 70 rpm
Add Twist cFBw 0 turn
Twist Feed Len lFBw 0 mm
Loose Len lFBbr 50 mm
Stop Angle aFBf 0 deg

Fig. 5 Sequence setting screen (Stop 2 page)



[5] Full-bobbin Stop (Stop 2)

Touching the Stop 2 tab on the sequence setting screen calls up the Stop 2 page (Fig. 5) on which you specify full-bobbin stop operation.

Operation sequence

(1) When the bobbin rail reaches the full-bobbin stop position, a full-bobbin operation starts depending upon the regular full-bobbin conditions, halfway doffing conditions, or scheduled doffing conditions.

(2) During a full-bobbin operation, the flyer speed (NFB) at full-bobbin stop applies.

(3) If specified, additional twisting is performed.

- With roving delivery being stopped, the flyer independently rotates by the "Add Twist" (cFBw).
- After that, the FL delivers roving by the "Twist Feed Len" (lFBw).

  NOTE: Setting the "Add Twist" (cFBw) to "0" disables the additional twisting function.

(4) The flyer independently rotates to add twists to roving.

NOTE: The flyer reverse operation for automatic winding is performed by the specified number of turns.

(5) The flyer stops in the "Stop Angle" (aFBf).

NOTE: The stop angle should be adjusted relative to the location of the flyer optimum position stop sensor (PRS1).

(6) The bobbins rotate in the reverse direction by the "Loose Len" (lFBbr) to loosen roving and then they stop.

- For details, refer to Chapter 7, Section 7.1.3, [5].

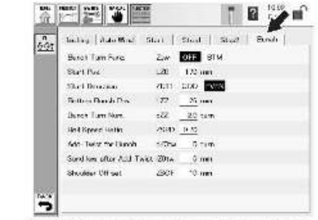
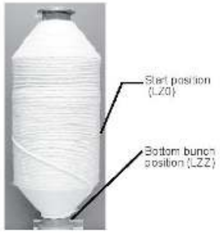


Fig. 6 Sequence setting screen (Bunch winding page)



[6] Bunch Winding

(Available only for FLs using bunch winding support presser)
Touching the Bunch tab on the sequence setting screen calls up the bunch winding page (Fig. 6) on which you make bunch related settings.

Operation sequence

(1) After a full-bobbin stop, a bunch winding operation starts if the Bunch Turn Func (Zsw) is set to BTM. (During the bunch winding operation, the flyer speed (NFB) at full-bobbin stop applies.)

(2) The bobbin rail moves up to the bottom bunch position (LZZ). During this up-movement, roving is spirally wound on the bobbin package.

(3) At the bottom bunch position, the FL winds roving by the "Bunch Turn Num."

NOTE: For details, refer to Chapter 7, Section 7.1.3. [15].

Entry items

(1) Bunch Turn Func. (Zsw)
OFF: No bunch winding
BTM: Perform bottom bunch winding

(2) Start Pos. (LZ0) and Start Direction (ZDIR)
The LZ0 specifies the bobbin rail position in which the bunch winding operation starts after a full-bobbin stop.
The ZDIR specifies the layer at which bunch winding starts.
ODD: Start bunch winding at an odd-numbered layer
EVEN: Start bunch winding at an even-numbered layer

(3) Bottom Bunch Pos. (LZZ)
The LZZ specifies the bobbin rail position for bunch winding.
Reference value: 26 mm

(4) Bunch Turn Num. (cZZ)
The cZZ specifies the number of turns of roving to be wound for bottom bunch building, as a guide.
Reference value: 2.0 turns

(5) Rail Speed Ratio (ZSPD)
The ZSPD specifies the maximum speed of the bobbin rail moving down to the bottom bunch position, as a ratio to the delivery speed.
Reference value: 0.40

(6) Add-Twist for Bunch (cZ0tw) and Send len. after Add-Twist (lZ0tw)
These items specify additional twisting to be performed before bunch winding in order to increase the strength of roving to be used for bunch winding.

(7) Shoulder Off set (ZSOF)
The ZSOF specifies the offset that should be adjusted during bunch winding when a roving break occurs due to high tension at the lower shoulder.
Reference value: 10 mm

- Adjust bunch winding operation while monitoring the roving delivery state.

5.1.8 Specifying the Roving Tension

The FL provides the stabilized winding of roving under tension control with the tension controller. For details, see the related parameters given below.

NOTE: For the roving tension control, refer to Chapter 7, Section 7.1.3, [3].

NOTE: For the origin position adjustment of the roving tension, refer to Chapter 3, Section 3.1.3, [5].

NOTE: For the roving tension adjustment procedure, refer to Chapter 6, Section 6.1.2.

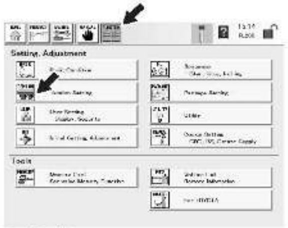


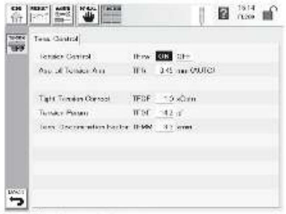
Fig. 1 Function menu

Tension control screen

- Touching the FUNCTION button in the top menu and the TENSION button in the function menu (Fig.1) calls up the tension control screen as shown in Fig. 2.

FUNCTION
TENSION

On this screen, the tension control related parameters can be configured.



Tension Control TFsw ON OFF

Tight Tension Control TFGF

Fig. 2 Tension control screen

[1] Tension Control ON/OFF

- If the tension controller is defective and unusable, the tension control can be disabled.

  Tension Control (TFsw)

  ON: Enable (usually)

  OFF: Disable (Disabling the tension control requires the Δ ϕ (Delta of package diameter) to be specified in the MANUAL mode.)

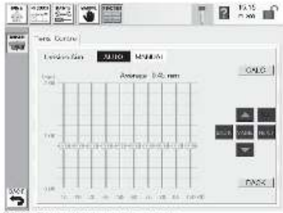


Fig. 3 Target tension setup screen

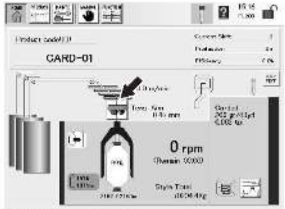


Fig. 4 Main (home) screen

[2] Target Tension of Roving

- The FL provides the target tension suited for the preset roving delivery conditions in the AUTO mode.
- It is also possible to arbitrarily specify the target tension of roving for each of wound percentages (10 stages).

Target tension entry procedure

(1) On the tension control screen (Fig. 2), touch the "Ave of Tension Aim" (TFA) field, and the target tension setup screen (Fig. 3) appears where you select AUTO or MANUAL tension setting mode.

Selection of target tension setting mode (TFA)

AUTO: Determines the target tension automatically according to the preset roving delivery conditions

MANUAL: Allows you to arbitrarily specify the target tension for each of wound percentages (10 stages).

(2) Select the AUTO tension setting mode and touch the CALC button, and the target tension average for a doffing sequence will be updated.

(3) Check the displayed target tension and touch the BACK button to return to the tension control screen (Fig. 2).

(4) On the tension control screen (Fig. 2), check the target tension and tension setting mode and then touch the SET button to establish them.

Ave. of Tension Aim TFA 0.55 mm (AUTO)

NOTE: Specifying target tension in MANUAL mode

Use the cop-related setter on a wound percentage basis (10 stages). For the operating procedure, refer to Section 5.1.2. [2.4.2]

NOTE: Making fine adjustment of target tension

It is possible to make fine adjustment of the target tension while monitoring the roving delivery state.

Touching the tension info display button on the main (home) screen (Fig. 4) calls up the tension info screen (Fig. 5) on which you use the tension adjustment buttons for fine adjustment. These adjustment buttons are enabled when the tension setting mode is AUTO.

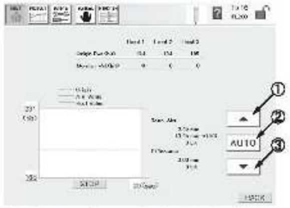


Fig. 5 Tension info screen (For fine adjustment of target tension

Tension adjustment buttons

1 UP button: At one touch of this button, the target tension value (roving defection) decreases by 0.05 mm.

2 AUTO button: Touching this button reverts the target tension to the reference value (AUTO value).

3 DOWN button: At one touch of this button, the target tension value (roving deflection) increases by 0.05 mm.

For the display items on this screen, refer to Section 5.1.2, [2.5], (4).

[3] Other parameters on the tension control screen

The following parameters on the tension control screen (Fig. 2) are important factors for tension control. Be careful when you change them.

- Tight Tension Correct (TFOF)
  Initial value: 1.0
  When the roving is kept tense for a long time during roving delivery, increasing this correction coefficient may solve the problem.
- Tension Param. (TFGF)
  Initial value: 12.0 gf
  This is used to calculate the target tension in the AUTO mode. Increasing this value decreases the target tension (roving deflection).
- Tens. Discrimination Factor (TFMM)
  Initial value: 3.3 mm
  This value determines the lower limit of the normal roving detection range of the tension sensor.

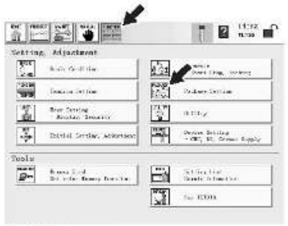


Fig. 1 Function menu

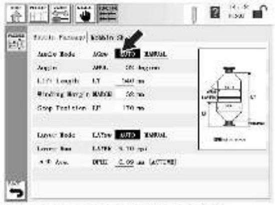


Fig. 2 Bobbin package configuration screen

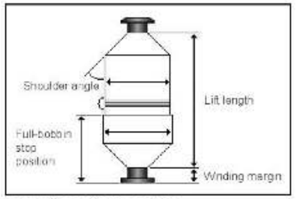


Fig. 3 Shape of bobbin package

5.1.9 Configuring the Bobbin Package

On the bobbin package configuration screen, enter the bobbin package shape (including the lift length and shoulder angle) and the bobbin shape.

Calling up the bobbin package configuration screen

- Touching the FUNCTION button in the top menu and the PACKAGE button in the function menu (Fig. 1) calls up the bobbin package configuration screen as shown in Fig. 2.

  FUNCTION PACKAGE

  The configuration screen consists of the following two pages that can be opened by touching the corresponding tab.

  - Bobbin Package: On this page, specify the bobbin package shape and the related items.
  - Bobbin Shape: On this page, specify the shape of bobbins to be used.

[1] Bobbin Package Shape

(1) Shoulder angle

- The shoulder angle is an important item for configuring a stabilized bobbin package shape. The FL provides the AUTO shoulder angle mode in which the shoulder angle suited for the preset roving delivery conditions can be selected automatically.
- An arbitrary shoulder angle can be specified in the MANUAL bobbin angle mode.

Selection of shoulder angle mode (AGsw)
AUTO: This mode determines the shoulder angle suited for the preset roving delivery conditions automatically. (Recommended mode) The automatically determined shoulder angle appears in the Angle field.
MANUAL: This mode uses the shoulder angle entered in the Angle field. It is not recommended that an angle greater than the automatically calculated one be entered in the Angle field. Entering a greater angle results in an easily deformable shoulder.

(2) Lift Length

This specifies the length of winding section on which roving should be wound.

(3) Winding Margin

This specifies the winding margin measured from the bobbin bottom.

NOTE: Typical value: 29 mm

(4) Full-bobbin Stop Position

This specifies the bobbin rail stop position for bottom winding, which is measured from the bobbin bottom.

Since this stop position is concerned with the automatic roving cutting function, modifying the material (sliver type) or roving thickness may make it necessary to adjust this stop position.

NOTE: Winding margin + 50/tan (Shoulder angle) ≦ Stop position ≦ Lift length/2

[2] Number of Layers

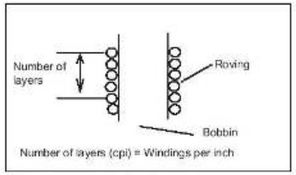


Fig. 4 Cross section of bobbin package

- This specifies the winding pitch between roving coils.
  For example,
  8.00 cpi means eight coils per inch.
- The number of layers is an important item for configuring a stabilized bobbin package shape and maintaining a stable supply of roving. The FL provides the AUTO layer mode in which the number of layers suited for the preset roving delivery conditions can be selected automatically.
- An arbitrary number of layers can be specified in the MANUAL layer mode.

Selection of layer mode (LAYsw)

AUTO: This mode determines the number of layers suited for the preset roving delivery conditions automatically. (Recommended mode) The automatically determined number of layers appears in the LAYER field.

MANUAL: This mode uses the number of layers entered in the LAYER field.

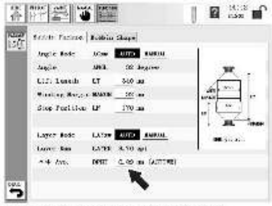


Fig. 5 Bobbin package configuration screen

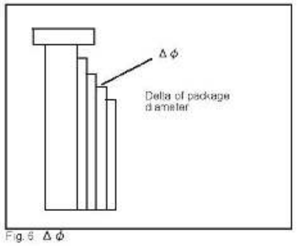


Fig. 6 Δ φ

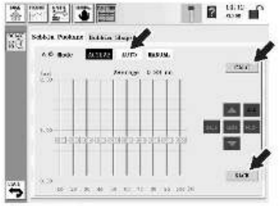


Fig. 7 Δ φ setup screen

[3] Δ φ (Delta of Package Diameter)

- The FL uses the Δ φ (Delta of package diameter) control parameter to determine the winding speed change at the change of layers and the bobbin rail reverse position. To configure a stabilized bobbin package shape, it is necessary to set the ?? suited for the roving delivery conditions.
- The FL provides the ACTIVE mode in which the Δ φ is automatically corrected depending upon the roving delivery state.
- An arbitrary Δ φ can also be specified for each of wound percentages.

Δ φ entry procedure

(1) On the bobbin package configuration screen (Fig. 5), touch the "Δ φ Ave." (DPHI) field, and the ?? setup screen (Fig. 7) appears where you select the Δ φ mode.

Selection of Δ φ mode
ACTIVE: Monitors the roving delivery state with the tension controller and optimizes the Δ φ automatically (Recommended mode)
AUTO: Determines the Δ φ automatically according to the roving delivery conditions.
MANUAL: Allows you to arbitrarily specify the Δ φ for each of wound percentages (10 stages). Select this mode when the tension controller is not used.

(2) Select the AUTO mode and touch the CALC button, and the Δ φ average for a doffing sequence will be updated.

(3) Check the displayed Δ φ and touch the BACK button to return to the bobbin package configuration screen (Fig. 5).

(4) On the bobbin package configuration screen (Fig. 5), check the average Δ φ and the Δ φ mode and then touch the SET button to establish them.

Δ Φ Ave. DPHI 0.89 mm (ACTIVE)

NOTE: Specifying the Δ φ in MANUAL mode
Use the cop-related setter on a wound percentage basis (10 stages). For the operating procedure, refer to Section 5.1.2. [2.4.2].

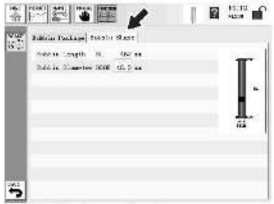
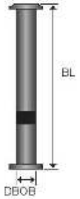

Bobbin Package
Bobbin Shape
Bobbin Length BL
Bobbin Diameter DBOB

Fig. 8 Bobbin shape configuration screen



[4] Bobbin Shape

Touching the Bobbin Shape tab on the bobbin package configuration screen (Fig. 5) calls up the bobbin shape configuration screen as shown in Fig. 8.
On this screen, the following bobbin shape parameters can be configured.

Entry items

(1) Bobbin Length

(2) Bobbin Diameter

NOTE: The overall length of the bobbin differs depending upon the specifications, so refer to the bobbin dimensional drawings separately issued.

NOTE: The bobbin length should be within the following range
Standard version
Bobbin length + Doffing position ≦ 494
FRD version.
Bobbin length + Doffing position ≦ 496

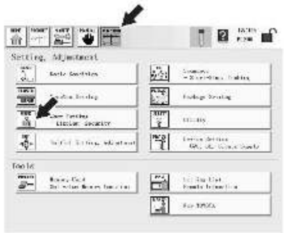


Fig. 1 Function menu

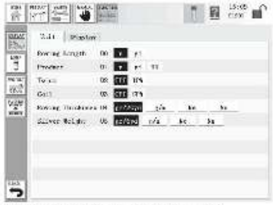


Fig. 2 Display screen (Unit selection page)

5.1.10 User Setting

- On the user setting screen, you can customize the display items to suit the user preferences and configure the protection functions for some operations provided on the function panel against accidental access.

[1] Sub Menu Configuration

- Touching the FUNCTION button in the top menu and the USER button in the function menu (Fig.1) calls up the unit selection screen as shown in Fig. 2

FUNCTION USER

The sub menu containing the following buttons is also displayed vertically at the left end of the screen (Fig. 2).

DISPLAY	Touch this button to set up the display-related items on the main (home) screen e.g., selecting the units of roving length and production length and entering the FL name.
LAMP	Touch this button to configure the lighting conditions of the signal indicator (tower lamp).
PROTECT	Touch this button to set up the misoperation protection.
PASSWD	Touch this button to change the password being used for protection of the roving conditions.
BACK	Touch this button to return to the function menu.

Touching the USER button first displays the display screen (Fig. 2). Touch the button of the desired item in the sub menu, and the related screen appears.

NOTE: If selected, the button turns orange.

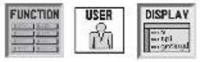
To return to the main (home) screen, touch the HOME button in the top menu.

[2] Display

(1) Selecting the units of display items such as roving length and production length

Touching the USER button in the function menu calls up the unit selection page (Fig. 1).

NOTE: Touch the Unit tab if it has not been selected.



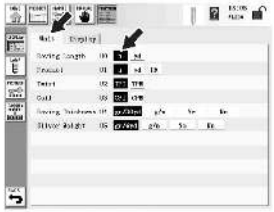


Fig. 1 Unit selection screen

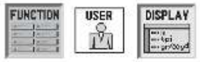
Touch the field of the desired unit to change the setting.

Unit systems supported
  Roving length: m, yd
  Production length: m, yd, HK
  Number of twists: TPI, TPM
  Coil: CPI, CPM
  Roving thickness (weight): gr/30yd, g/m, Ne, Nm
  Sliver weight: gr/6yd, g/m, Ne, Nm

(2) Entering the FL name

The FL name entered on this screen is displayed in the top menu. It is also used as a file name of data saved into a memory card.

- Touching the USER button in the function menu calls up the unit selection page (Fig. 1).



Touch the Display tab to call up the display item configuration screen (Fig. 2).

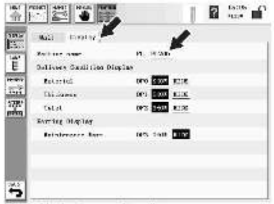


Fig. 2 Display item configuration screen

- Turn the setting-enable (DATA SET) key to the DATA SET position.
- Touching the field of machine name (FL) calls up the keyboard (Fig. 3).
- Enter a desired FL name using the keyboard.

TIP: To enter "FL001," for example, touch "Caps Lock," "F," "L," "0," "0," "1," and "Enter" keys in this order. Up to six characters can be entered.

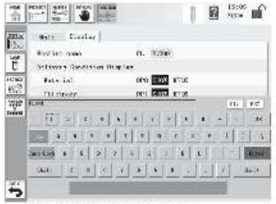


Fig. 3 Keyboard for entry of FL name

NOTE: Touching unavailable keys (such as the space key and Tab key) produces nothing.

Touch the SET button provided in the bottom right corner of the screen to finish the setting procedure.

- The "Processed normally" message appears indicating the completion of the setting.
  (Turn the setting-enable (DATA SET) key back to the original position.)
  The CANCEL and SET buttons disappear.

If any error occurs, check the contents and perform the setting procedure again.

NOTE: Touching the CANCEL button clears the new entry.

[3] Lamp

(1) Setting the signal indicator (tower lamp)

The lighting colors and ON/Blink condition can be selected.

Touching the USER button in the function menu and the LAMP button in the sub menu calls up the tower lamp screen shown in Fig. 1.

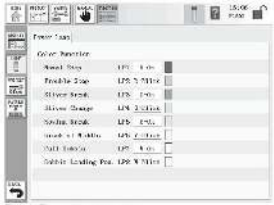
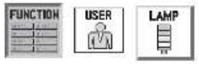


Fig. 1 Tower lamp screen



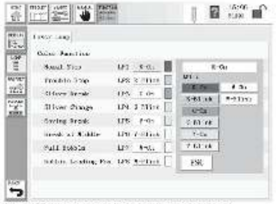


Fig. 2 Tower lamp screen (setup in progress)

Events

- Normal Stop (Default: Red-On)
- Trouble Stop (Default: Red-Blink)
- Sliver Break (Default: Green-On)
- Sliver Change (Default: Green-Blink)
- Roving Break (Default: Yellow-On)
- Break at Middle (Default: Yellow-Blink)
- Full Bobbin (Default: White-On)
- Bobbin Loading Pos. (Default: White-Blink)

NOTE: Each of the following combinations of lighting color and On/Blink condition can be assigned to each event: "Red-On," "Red-Blink," "Green-On," "Green-Blink," "Yellow-On," "Yellow-Blink," "White-On," and "White-Blink."

NOTE: The selected color is displayed on the right of each field.

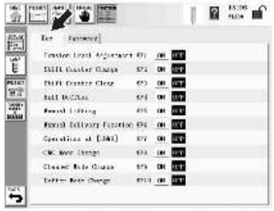


Fig. 1 Protection setup screen (for key protection)

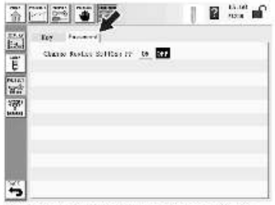


Fig. 2 Protection setup screen (for password protection)

[4] Protection

(1) Protecting from misoperation

- Some screen operations can be made allowed only when the setting-enable (DATA SET) key is in the DATA SET position, which prevents accidental access to such operations. (Key protection)

1) Touching the USER button in the function menu and the PROTECT button in the sub menu calls up the protection setup screen (Fig. 1).

FUNCTION
USER
PROTECT

Operations protected by the setting-enable (DATA SET) key (Key protection) (Fig. 1)

Tension Level Adjustment
Shift Counter Change
Shift Counter Clear
Half Doffing
Manual Lifting
Manual Delivery Function (Roving assist)
Operations at [HOME]
CWC Mode Change
Cleaner Mode Change
Doffer Mode Change

NOTE: Selecting "ON" enables the key protection for the corresponding item.

Operations protected by a password (Password protection) (Fig. 2)

Changing roving conditions

NOTE: Selecting "ON" enables the password protection of roving conditions so that changing basic roving conditions accessible by selecting FUNCTION | BASIC | ROVING requires entering a password.

NOTE: Changing the password protection parameter on this screen also requires entering a password.

[5] Password

(1) Changing the password being used for protecting roving conditions

The default password is "1414." It can be changed to other case-insensitive alphanumeric characters.

Caution: Be sure to keep your password safe and do not forget it.

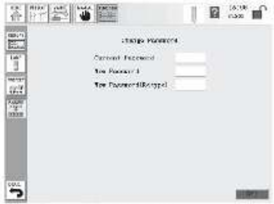

Change Password
Current Password
New Password
New Password(Retype)

Fig. 1 Password change screen

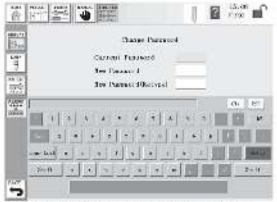
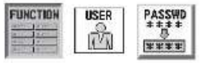

Change Password
Current Password
New Password
New Password(Retype)

Fig. 2 Password change screen (with keyboard)

Password changing procedure

1) Touching the USER button in the function menu and the PASSWD button in the sub menu calls up the password change screen (Fig. 1).


FUNCTION
USER
PASSWD
****
****

2) Turn the setting enable (DATA SET) key to the DATA SET position.

3) Touch the Current Password field, and the keyboard appears as shown in Fig. 2. Enter the current password. (Entered characters will be indicated as " * ".)

4) Enter a new password to the New Password field. (Entered characters should be case-insensitive alphanumeric characters and they will be indicated as " * ".)

5) Enter the new password again to the New Password (Retype) field. (Entered characters will be indicated as " * ".)

6) After performing steps 3) through 5) above, touch the SET button.

The "Processed normally" message appears, indicating the completion of the password change.

If "Incorrect password" message appears, there is an error in the passwords entered in steps 3) through 5). Repeat those steps and enter the passwords correctly.

5.1.11 Utility

The FL can perform efficient operation using the sliver change setup function and the scheduled doffing function in which the production length under the same roving conditions is maximized according to the production schedule.

Sub menu configuration

- Touching the FUNCTION button in the top menu and the UTILITY button in the function menu (Fig. 1) calls up the sliver change setup screen (Fig. 2).

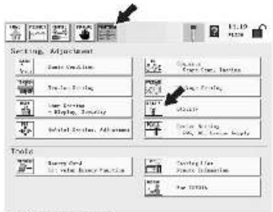


Fig. 1 Function menu

FUNCTION **UTILITY**

The sub menu containing the following buttons is also displayed vertically at the left end of the screen (Fig. 2).

SLIVER Touch this button to configure the sliver change setup function.

SCHEDULE DOFFING Touch this button to configure the scheduled doffing function.

[1] Configuring the Sliver Change Setup Function

The sliver change setup function arranges for roving sections corresponding to the seams of slivers (bound together at the replacement of cans) to come to the 1st layers on bobbins of roving in order to prevent those roving sections from becoming cops on spinning frames for quality of spun yarn. This minimizes the roving loss.
(This function is useful for changing a row of sliver cans.)

For details of the sliver change setup operation and settings, refer to Chapter 7, Section 7.1.3, [16].

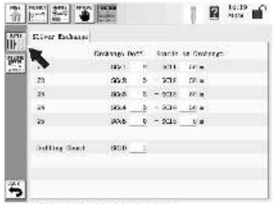


Fig. 2 Sliver change setup screen

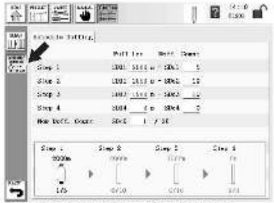


Fig. 3 Scheduled doffing configuration screen

[2] Configuring the Scheduled Doffing Function

The scheduled doffing function supplies bobbins of roving having different production lengths according to schedule for preparation of roving setup change in the spinning process.
For up to four setups, the full-bobbin length and doff count can be specified.

Entry items

Full-bobbin length (SDl1) and doff count (SDc1) for Setup 1 (Step 1).
Full-bobbin length (SDl2) and doff count (SDc2) for Setup 2 (Step 2).
Full-bobbin length (SDl3) and doff count (SDc3) for Setup 3 (Step 3).
Full-bobbin length (SDl4) and doff count (SDc4) for Setup 4 (Step 4).

NOTE: Entering 0 to the doff count ignores the corresponding step.

NOTE: Entering 0 to the current doff count (SDcD) disables the scheduled doffing.

Operation overview

- After setting the full-bobbin length and the doff count for each of Steps 1 through 4, entering 1 to the current doff count starts the scheduled doffing.
- The FL produces the full-bobbin length (SDl1) specified for Step 1 repeatedly up to the specified doff count (SDc1).
- The FL produces the full-bobbin length (SDl2) specified for Step 2 repeatedly up to the specified doff count (SDc2).
- The FL produces the full-bobbin length (SDl3) specified for Step 3 repeatedly up to the specified doff count (SDc3).
- The FL produces the full-bobbin length (SDl4) specified for Step 4 repeatedly up to the specified doff count (SDc4).
- After completing the production of Steps 1 through 4, the FL starts production in accordance with the full-bobbin length specified in the "Basic Condition" window. (The current doff count will be automatically reset to 0.)

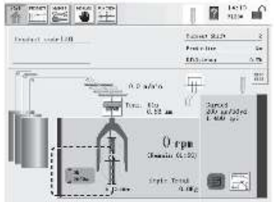
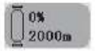


Fig. 4 Main (home) screen (scheduled doffing in progress)

For details of the scheduled doffing operation and settings, refer to Chapter 7, Section 7.1.3, [19].

Display

When scheduled doffing is in progress, an icon given below appears on the main (home) screen.



Upper row: Wound percentage to the full-bobbin length in scheduled doffing

Lower row: Preset roving delivery length in scheduled doffing

5.1.12 Initial Settings and Adjustments

The FL cannot run without zero point setting of the bobbin rail and origin setting of the tension level. Those setting and adjustment items requisite for running the FL are arranged on the Initial Setting & Adjustment menu.
Be sure to confirm those setting and adjustment items after installation of the FL or replacement of the CPU board.

[1] Initial Setting & Adjustment Menu

- Touching the FUNCTION button in the top menu and the INIT button in the function menu (Fig. 1) calls up the password entry screen as shown in Fig. 2.

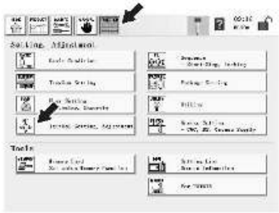


Fig. 1 Function menu

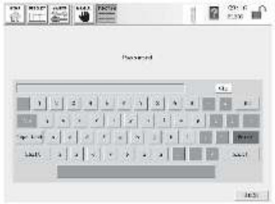


Fig. 2 Password entry window
(Touch "1," "4," "1," "4," and "Enter.")

FUNCTION **INIT**

- Entering the password "1414" and touching the Enter button calls up the Initial Setting & Adjustment menu as shown in Fig. 3.

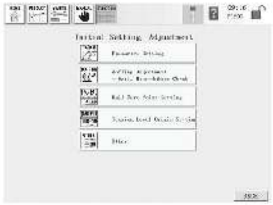


Fig. 3 Initial Setting & Adjustment menu

PARAM	Touch this button to set up various offset parameters.
DOFFING	Touch this button to set up the bobbin rail stop position in doffing operation.
RAIL INIT	Touch this button to perform zero point setting of the bobbin rail.
TENS INIT	Touch this button to perform origin setting of the tension level.
OTHER	Touch this button to perform other initial settings.

Touch the BACK button to return to the function menu.
Touch the HOME button to return to the main (home) screen.

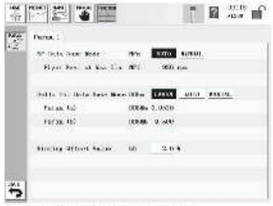


Fig. 4 Offset parameter setting screen

[2] Various Offset Parameters

- Touching the PARAM button in the Initial Setting & Adjustment menu (Fig. 3) calls up the offset parameter setting screen (Fig. 4.)
  On this screen, the LF control parameters can be manually adjusted.
  Usually no change is required as long as the FL performs roving normally.

PARAM

PARAM button

(1) NF data base mode (NFm)

This specifies the flyer speed limit selection mode. The limit of the flyer speed (rpm) at the maximum package diameter determines the flyer speed change curve in AUTO mode. (Usually, "AUTO" is selected.)

AUTO: The flyer speed (rpm) is automatically calculated according to the database in the program.
MANUAL: The flyer speed (rpm) specified by the NFf on this screen applies.

NOTE: In MANUAL mode, roving may become unstable.

(2) Δ φ data base mode (DDBm)

This specifies the Δ φ calculation parameter selection mode. The calculation parameters are used to calculate the Δ φ of package diameter at the change of layers. (Usually, "LEARN" is selected.)

LEARN: Calculates the optimum parameters based on the production result database.
AUTO: Estimates the optimum parameters based on the delivery result of the last doff.
MANUAL: Uses parameters (a) and (b) specified on this screen.

NOTE: In MANUAL mode, roving may become unstable.

(3) Winding offset value
This specifies the offset value for the winding speed (rpm). (Reference value: 2.0%)

NOTE: Unless otherwise specified, do not change this value.

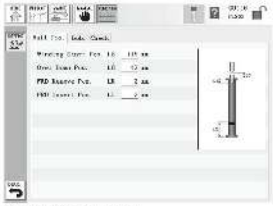
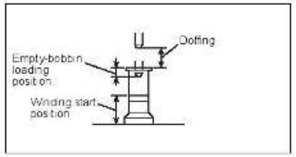


Fig. 5 Doffing setup screen



[3] Doffing Operation

- In the Initial Setting & Adjustment menu (Fig. 3), touching the DOFFING button calls up the doffing setup screen (Fig. 5).
  This screen allows you to adjust the stop position to be used in rail movement triggered by the bobbin rail UP/DOWN switches in doffing.

DOFFING

DOFFING button

Bobbin rail stop position

(1) Winding start position
Specify the height from the bottom of bobbins so that the presser eye comes to the height a little higher than the special cloth wound on bobbins.
Reference value for bobbins recommended by Toyoda: 110 mm

(2) Doffing position (over-down position)
Specify the bobbin rail position for unloading full bobbins by entering a distance between the upper end of bobbins and the end of spindles.
Reference value:
Standard version: 42 mm
FRD version: 44 mm

(3) Empty-bobbin loading position
Specify the bobbin rail position for loading full bobbins by entering an overlap distance of the end of spindles in bobbins.
Reference value: 7 to 9 mm

NOTE: Specifying a too small value may increase the risk of knock-up accidents caused by an empty bobbin loading failure.

For details of the doffing operation, refer to Chapter 4, Section 4.1.3.

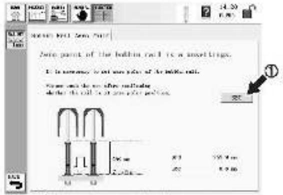
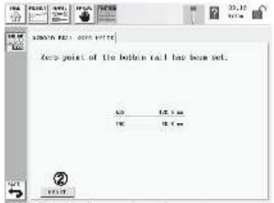


Fig. 4 Bobbin rail zero point setting screen
(Not configured yet)



Zero point of the bobbin rail has been set.

Fig. 5 Bobbin rail zero point setting screen
(Already configured)

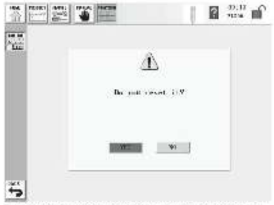


Fig. 6 Confirmation screen for changing the bobbin rail zero point

[4] Bobbin Rail Zero Point Setting (Refer to Chapter 3, Section 3.1.3 [4].)

- Touching the FUNCTION button in the top menu and the INIT button in the function menu (Fig. 1) calls up the password entry screen.

FUNCTION INIT

- Entering the password "1414" and touching the Enter button calls up the Initial Setting & Adjustment menu as shown in Fig. 3.

(1) In the Initial Setting & Adjustment menu (Fig. 3), touching the RAIL INIT button calls up the bobbin rail zero point setting screen (Fig. 4 or Fig. 5).

RAIL INIT 000 RAIL INIT button

NOTE: If the bobbin rail zero point has not yet been configured, the screen with the warning message W-57 is displayed as shown in Fig. 4.

NOTE: If the bobbin rail zero point has already been configured, the screen as shown in Fig. 5 appears.

NOTE: To change the already-configured bobbin rail zero point, touch the RESET button (② in Fig. 5), and the confirmation screen (Fig. 6) appears. Touching the YES button returns to the screen as shown in Fig. 4.

(2) Check that the bobbin rail is in the prescribed position given below.
Reference value (Distance between the upper end of bobbins and the end of spindles)
Standard version: 494 mm
FRD version: 496 mm

Touch the SET button (① in Fig. 4).
(Turn the setting-enable (DATA SET) key to the DATA SET position.)

NOTE: Use the prescribed handle to move the bobbin rail. For details of the handle operation, refer to Chapter 3, Section 3.1.3 [2].

(3) The confirmation screen (Fig. 6) appears. To set the new zero point, touch the YES button. After the setting has normally completed, the screen shown in Fig. 5 appears.

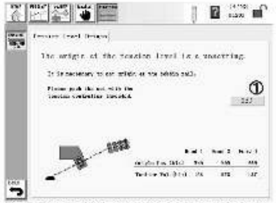


Fig. 7 Tension level origin setting screen (Not configured yet)

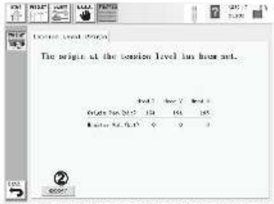

The origin of the tension level has been set.

Fig. 8 Tension level origin setting screen (Already configured)

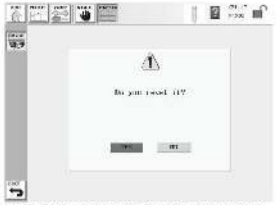

Do you reset it?

Fig. 9 Confirmation screen for changing the tension level origin

[5] Tension Level Origin Setting (Refer to Chapter 3, Section 3.1.3 [5].)

- Touching the FUNCTION button in the top menu and the INIT button in the function menu (Fig. 1) calls up the password entry screen.

FUNCTION
INIT
F1

- Entering the password "1414" and touching the Enter button calls up the Initial Setting & Adjustment menu as shown in Fig. 3.

(1) In the Initial Setting & Adjustment menu (Fig. 3), touching the TENS INIT button calls up the tension level origin setting screen (Fig. 7 or Fig. 8).

TENS INIT button

NOTE: If the tension level origin has not yet been configured, the screen with the warning message W-58 is displayed as shown in Fig. 7.

NOTE: If the tension level origin has already been configured, the screen as shown in Fig. 8 appears.

NOTE: To change the already-configured tension level origin, touch the RESET button (? in Fig. 8), and the confirmation screen (Fig. 9) appears. Touching the YES button returns to the screen as shown in Fig. 7.

(2) With a leveling string being set through the tension controller, touch the SET button (? in Fig. 7).
(Turn the setting-enable (DATA SET) key to the DATA SET position.)

(3) The confirmation screen (Fig. 9) appears. To set the new tension level origin, touch the YES button. If the setting has normally completed, the screen shown in Fig. 8 appears.

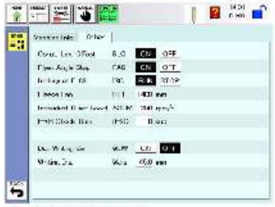


Fig. 10 Other setting screen

[6] Other Parameter Settings

- In the Initial Setting & Adjustment menu (Fig 3), touching the OTHER button calls up the other setting screen (Fig. 10).
  On this screen, the following parameters can be specified.

OTHER OTHER button

Entry items

(1) MFG No.(MFG)
An MFG number is set.

(2) Specification No. (Sn)
A specification number is set.

(3) User name (Un)
A user name is set.

(4) Constant length offset (SLC)
ON: Performs the constant length offset at a full-bobbin stop. (Default)
OFF: Does not perform the constant length offset at a full bobbin stop.

(5) Flyer angle stop (FAS)
ON: Performs the flyer angle stop at a normal stop. (Default)
OFF: Does not perform the flyer angle stop at a normal stop.

(6) Inching operation upon empty bobbin (ISC)
[Run] Inching operation is possible even when the empty bobbin sensor is shielded.
[Stop] Inching and running stop when the empty bobbin sensor is shielded.

(7) Fleece length (IFLE)
The IFLE specifies the fleece feeding length in manual operation.
(Initial value: 1400 mm)

(8) Acceleration in driving motors individually (ACCM)
The ACCM specifies the acceleration for driving motors individually in manual operation.
(Default value: 250 rpm/s)

(9) Flyer cover check time (tFTSC) (Option)
Does not detect that the flyer cover detection sensor is shielded during the set time. (Initial value : 1.0sec)

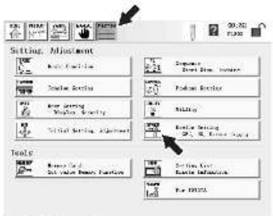


Fig. 1 Function menu

(10) Forced writing of bobbin package diameter (WDW) and Bobbin package diameter to be written (Wdia)

If the FL cannot perform normal winding because the package diameter recognized by the CPU is abnormal, specifying this parameter forcibly overwrites the diameter.

1) Enter an appropriate value in the "Writing Dia." (Wdia) field.

2) Touch the ON button for the "Dia. Writing Sw" (WDW) parameter.

3) Touch the SET button provided in the bottom right corner of the screen to finish the setting procedure.

4) Confirm the settings on the sub monitor screen called up by selecting MAINTE | SUB MONI.

NOTE: Incorrect setting of these parameters cannot run the FL correctly.

5.1.13 Device Settings

- The Device Setting menu allows you to make settings of the greasing or cleaning system.
- Touching the FUNCTION button in the top menu and the DEVICE button in the function menu (Fig. 1) calls up the "Grease Supply Device" window (Fig. 2).

FUNCTION **DEVICE**

The sub menu containing the following buttons is also displayed vertically at the left end of the screen (Fig. 2).

GREASE Greasing setting button
Touch this button to make settings of the greasing system.

CLEANER Cleaning device setting button
Touch this button to make settings of the CWC unit and the blow cleaner.

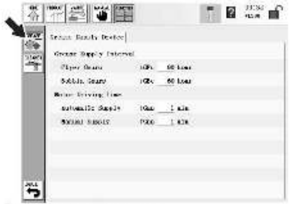


Fig. 2 Greasing setting screen

[1] Greasing System

On the "Grease Supply Device" window, you can make settings of the greasing system for flyer gears and bobbin gears.

(1) Grease Supply Interval

- Specify lubrication intervals for flyer gears and bobbin gears independently. (Initial value: 60 hours)

(2) Lubricating Periods (Motor Driving Time)

- Specify lubricating periods for automatic lubrication and manual lubrication independently.

Operation overview

- When the bobbin rail moves down below the over-down position during doffing operation after the specified lubrication interval has elapsed, lubrication starts automatically.
- Lubrications for flyer and bobbin gears do not performed simultaneously. (If the lubrication cycles for both gears are overlapped, lubrication for the flyer gears has priority and the bobbin gears will be lubricated at the next doffing timing.)
  NOTE: For details, refer to Chapter 7, Section 7.1.3, [12].

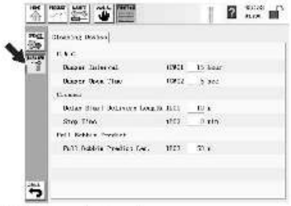


Fig. 3 Cleaning device setting screen

[2] CWC Unit

(1) Dumper Interval
Specify the opening interval of the waste collector dumper in the CWC unit.

(2) Damper Open Time
Specify the opening period of the waste collector dumper in the CWC unit.

NOTE: These functions are available only when the FL is equipped with a CWC unit.

[3] Blow Cleaner

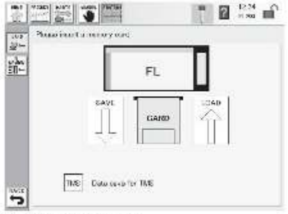
(1) Delay Start Delivery Length
Specify the roving length to be delivered after the start of the FL and before the start of the blow cleaner.

(2) Stop Time
Specify the period for which the blow cleaner stops in the standby position during its operation.

(3) Full Bobbin Predict Length

Specify the delivery length to be applied when the blow cleaner should be evacuated before the roving delivery reaches the preset full-bobbin prediction length.

NOTE: Note: The functions (1) and (2) are available only for FLs equipped with a BS or D type blow cleaner.



Please insert a memory card

Fig. 1 Memory card screen

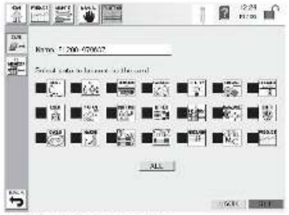


Fig. 2 Send data selection screen

5.1.14 Use of Memory Card

The FL can save the setting data and others into a memory card and load the saved data from the memory card into the FL.

[1] Memory Card Screen

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) In the top menu, touch the FUNCTION button to call up the function menu. Touch the CARD button in the sub menu at the left end of the screen, and the memory card window appears as shown in Fig. 1.
(The CARD button is selected in Fig. 1.)

[2] Saving the FL Data Into a Memory Card

(1) Insert a memory card into the specified card slot.

(2) On the memory card screen (Fig. 1), touch the [SAVE ⇩] button, and the send data selection screen appears as shown in Fig. 2.

(3) On this screen, select data groups to save into the memory card. The ones with a check mark on the left check box will be saved. Each time a data group button is touched, the button toggles ON and OFF (a check mark appears and disappears alternately).
Touching the ALL button selects or deselects all data groups.

(4) The standard format of a file name is "FLname-Date-Time." To change a file name, touch the name box and enter a new name using the keypad that appears (Fig. 3).

NOTE: When a user name or a specification number has been set (see 5.1.12[6]), blackening the checkbox shown as (1) will add [User name_Specification No.] to the file name automatically.

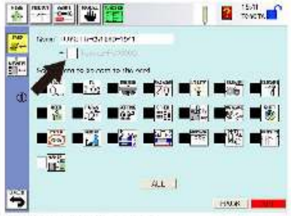
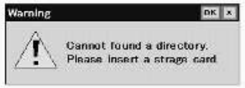


Fig. 3 File name entry screen

(5) After specifying data groups to save and the file name, touch the SET button. The "Select a File" dialog appears as shown in Fig. 5.

TIP: If the memory card is not recognized due to an insertion failure or other reasons, the warning message shown in Fig. 4 appears. Check that the card is correctly inserted.

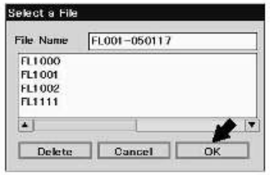


Cannot found a directory.
Please insert a strage card.

Fig. 4 No-card warning

(6) Confirm the file name and touch the OK button in the "Select a File" dialog to save the data into the memory card.

TIP: If no error occurs, the "Select a File" dialog disappears.

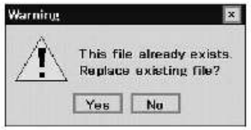


File Name FL001-050117

FL1000
FL1001
FL1002
FL1111

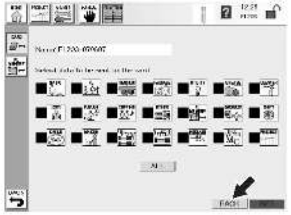
Fig. 5 "Select a File" dialog

TIP: Tip: If the specified file name already exists, the overwriting confirmation warning appears as shown in Fig. 6. To overwrite the existing file, touch the Yes button. To cancel the data saving, touch the No button, the Cancel button in the "Select a File" dialog in Fig. 5, and the BACK button in the send data selection screen (Fig. 2). Then go back to step (2).



This file already exists.
Replace existing file?

Fig. 6 Overwriting confirmation warning

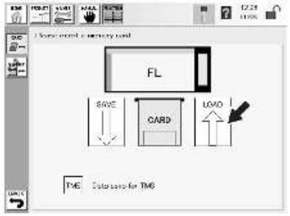


(7) When the data saving has been completed, the send data selection screen (Fig. 2) appears. Touch the BACK button to return to the memory card screen (Fig. 1).

[3] Loading the Saved Data from the Memory Card

(1) Insert the desired memory card into the specified card slot.

(2) Touch the [LOAD ⇧] button on the memory card screen, and the select file screen appears as shown in Fig. 7.



(3) On the select file screen, touch the BROWSE button, and the Select Upload File window (Fig. 8) pops up.

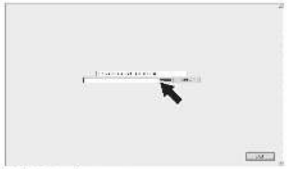
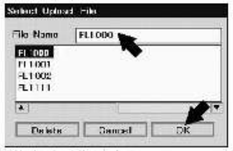


Fig. 7 Select file screen



Select Upload File

File Name: FL1000

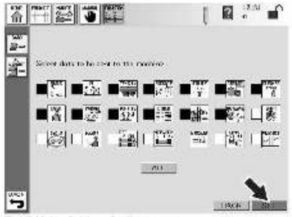
Fig. 8 Select upload file window

(4) Touch a file name to upload in the file name display area and confirm that the selected file name appears in the File Name box.

TIP: If the selected file name does not appear in the File Name box, touch it again in the file name display area.

(5) After selecting a file to upload, touch the OK button in the Select Upload File window. The selected file name appears in the select file screen (Fig. 7).

(6) Touch the SEND button in the select file screen, and the uploading data selection screen (Fig. 9) appears.

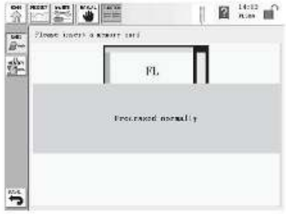


Select data to be sent to the machine

Fig. 9 Upload data selection screen

(7) Select data groups to upload to the FL. The ones with a check mark on the left check box will be uploaded. Each time a data group icon is touched, its ON and OFF status toggles (a check mark appears and disappears alternately). Touching the ALL button toggles the status of all data groups.

(8) After specifying data groups to upload, touch the SET button.



Please insert a memory card

Processed normally

Fig. 10 "Processed normally" message

(9) If all of the specified data has been uploaded successfully, the message "Processed normally" appears on the screen (Fig. 10). Then the display returns to the memory card screen (Fig. 1).

TIP: If an error occurs during uploading, the icons whose data groups have failed to be uploaded appear on the screen. Check if any error has occurred in the FL and retry the uploading.

5.1.15 Other Settings and Operation Examples

[1] List of Settings (Page 1)

With the list of settings, you can check for any errors in the FL machine setting data.

(1) Touching the FUNCTION button in the top menu and the INFO button in the function menu calls up the list of settings (Fig. 1).

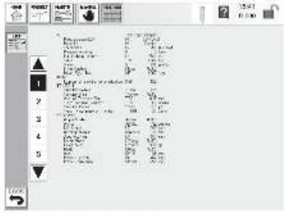


Fig. 1 List of settings (Page 1)

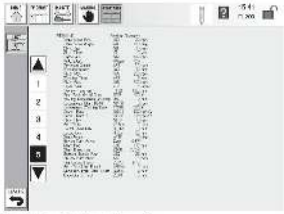


Fig 2 List of settings (Page 5)

(2) The list of settings consists of five pages.

Descriptions of displayed items

Each item is displayed in the order of group, name, symbol, and the current setting value.

NOTE: Items that have been changed from the initial values are shown in blue

- Touching the ▲ button goes to the previous page.
- Touching the ▼ button goes to the next page.
- Touching any of the 1 to 5 buttons jumps to the corresponding page directly.

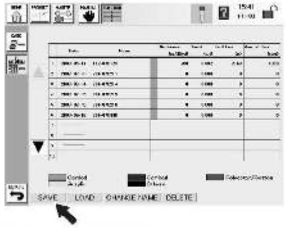


Fig. 1 Memory function screen

[2] Memory Function

The memory function saves the current FL setting values temporarily for use at a later time. Up to 50 setting value groups may be saved.

[2.1] Memory Function Screen

(1) Touch the FUNCTION button in the top menu.

(2) Touch the MEMORY button in the function menu.

FUNCTION button

MEMORY button

Touching the FL MEMORY button in the sub menu calls up the memory function screen (Fig. 1).

FL MEMORY button

[2.2] Saving Current FL Setting Data

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touching the SAVE button on the memory function screen (Fig. 1) calls up the where to save screen (Fig. 2) appears. Touch the field of data to be saved (to reverse it to "white letters on black background") and touch the SET button.

(3) Wait for the data name setting window (Fig. 3) to appear. In the name box, the data type appears if it has been specified, the setting number, if not. To change the data name, touch the Name box and enter a new name using the keypad that appears.

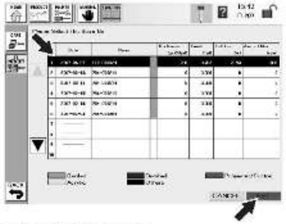


Fig. 2 Where to save screen

(4) After specifying a data name, touching the SET button completes the data saving. In the box with the corresponding data saving number on the memory function screen (Fig. 1), the date, name, thickness of roving, number of twists, full-bobbin length, and mean flyer speed are displayed (Fig. 4).

NOTE: If overwriting an existing data is attempted, the overwriting confirmation warning appears.

(5) Turn the setting-enable (DATA SET) key back to the original position.

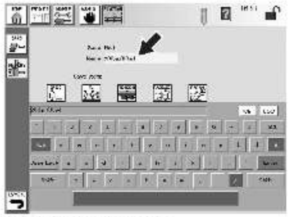


Fig. 3 Data name setting screen

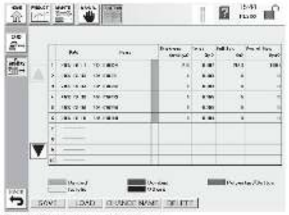


Fig. 4 Saving completed screen

[2.3] Loading the Saved Data into the FL

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touching the LOAD button on the memory function screen (Fig. 5) calls up the loading source selection screen (Fig. 6).

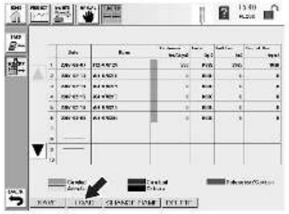


Fig. 5 Memory function screen

On the loading source selection screen, touch the field of data to be loaded into the FL (to reverse it to 'white letters on black background') and touch the SET button as shown in Fig. 6.

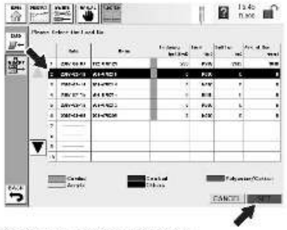


Fig. 6 Loading source selection screen

(3) Wait for the loading data selection screen (Fig. 7) to appear. Touch the desired icon of data to be loaded into the FL (to turn the box on its left side black). After selecting data to be loaded, touching the SET button completes the loading.

(4) Turn the setting-enable (DATA SET) key back to the original position.

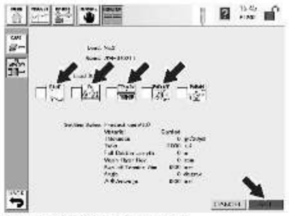


Fig. 7 Loading data selection screen

[2.4] Changing the Name of Saved Data

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touching the CHANGE NAME button on the memory function screen (Fig. 5) calls up the name change selection screen (Fig. 9).

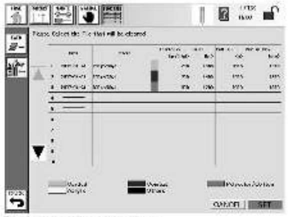


Fig. 8 Memory function screen

On the name change selection screen, touch the field of data whose name is to be changed and touch the SET button as shown in Fig. 9.

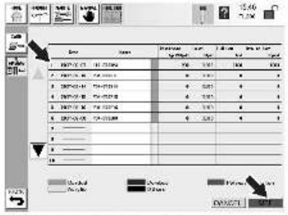


Fig.9 Name change selection screen

(3) Wait for the keypad to appear, enter a new data name, and touch the Enter button. (Fig. 10)

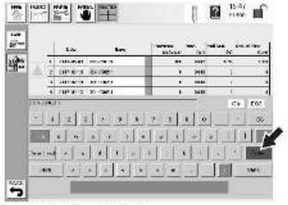


Fig. 10 Name change screen

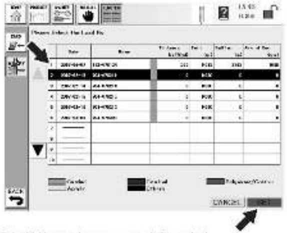


Fig. 11 Name change screen (after entry)

(4) After confirming that the data name has been changed correctly, touching the SET button completes the name change.

(5) Turn the setting-enable (DATA SET) key back to the original position.

[2.5] Deleting the Saved Data

(1) Turn the setting-enable (DATA SET) key to the DATA SET position.

(2) Touching the DELETE button on the memory function screen (Fig. 12) calls up the deleting data selection screen (Fig. 13).

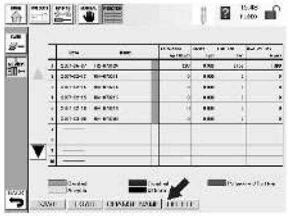


Fig. 12 Memory function screen

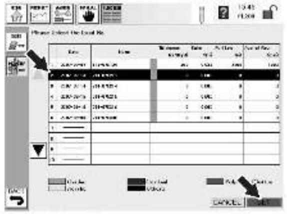
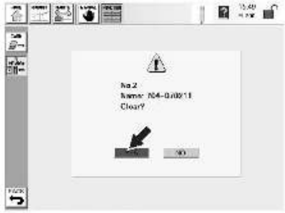


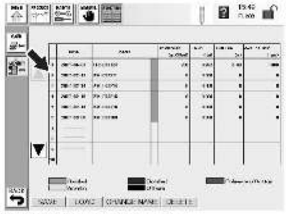
Fig. 13 Deleting data selection screen

On the deleting data selection screen, touch the field of data to be deleted (to reverse it to "white letters on black background") and touch the SET button as shown in Fig. 13.



No.2
Name: 704-070711
Clear?

Fig. 14 Deletion confirmation screen



BACK
SAVE
LOAD
CHANGE NAME
DELETE

Fig. 15 Deletion completion screen

(3) Wait for the deletion confirmation screen to appear. Touching the YES button completes the data deletion.

(4) Turn the setting-enable (DATA SET) key back to the original position.

5.1.16 Screen Hierarchy List

Top menu	Sub menu	Screen description	Related section
Home			
HOME		- Main (home) screen Displays the real-time data of the FL running status and production state. Registers the start and end of maintenance jobs. Allows fine adjustment of the target tension values. Displays the running information of the FL. Customizes the display items in the customizable area of the main (home) screen. DISP EDIT	5.1.2 [2-5]
Production information			
PRODUCT	REPORT	- Report screen Displays the production information for the past one week. Displays the operating rate (efficiency) transition graph.	5.1.3 [2]
	COUNTER 0001m	- Counter screen Displays the total production length on a shift basis. Allows manual shift switching.	5.1.3 [3]
	P.LOG	- Production log screen Displays the last 30 production records for each spinning condition. Displays the last 50 doffing results.	5.1.3 [4]
	SHIFT	- Shift schedule setting screen Makes out an automatic shift change schedule.	5.1.3 [5]
	CLOCK	- Clock configuration screen Configures the system clock.	5.1.3 [6]
Maintenance information			
MAINTE	SUB MONI	- Sub monitor screen Displays the measured speed (rpm) of each motor shaft and other values of the current operation in real time.	5.1.4 [2]
	24H LOG	- 24H log screen Displays the FL running state in the last 24 hours graphically. Displays the stop motion occurrence states for the last five doffs.	5.1.4 [3]
	MESSAGE	- Message log screen Displays up to the last 100 records of troubles that have occurred in the past. Displays up to the last 100 records of stop motions that have occurred in the past. Displays up to the last 100 records of operation motions that have occurred in the past.	5.1.4 [4]
	CHECK	- Check screen Displays basic information of each motor shaft. Displays input/output information (I/O monitor). Provides the battery check function.	5.1.4 [5]

Top menu	Sub menu	Screen description	Related section
MAINTE	CYCLE	• Maintenance alarm setting screen Sets up the maintenance alarm items and their pop-up intervals for maintenance purpose.	5.1.4 [6]
Manual operation			
MANUAL		• Manual operation screen Allows manual operation for driving motors individually. Changes doffing modes. Allows halfway doffing and scheduled doffing.	5.1.5
Setting up of functions			
FUNCTION	See the next Page.	• Function menu (function mode) Sets up the roving delivery conditions, operation sequence, and other basic conditions. Makes user settings including the FL model and display unit. Provides the setup tools such as a memory card and memory function and shows a list of setting.	5.1.5 to 5.1.6
Trouble			
		• Trouble message screen Flashes the trouble display button when any trouble is present. Displays the current trouble. Displays the trouble list screen if more than one trouble occurs.	5.1.2 [2.3]
Help			
?		• Help screen Displays the versions of programs and FL specifications file. Displays contents of typical FL trouble for reference. Displays the T.D.C., B.D.C., and other information for reference.	
Setting up of functions FUNCTION	Roving condtions BASIC	• Roving conditions screen - Sets up the basic roving conditions including the thickness (weight) of roving, number of twists, full bobbin length, and flyer speed (rpm). - Specifies the mechanical adjustment values. - Specifies the production data. ROVING MECHA MONI	5.1.6
	Sequence setting FL	• Sequence setting screen for making the FL start/stop related settings - Specifies the inching speed (rpm) and slow time. - Sets up automatic winding. - Makes the start/stop related settings.	5.1.7
	Tension control TENSION	• Tension control screen - Specifies the target tension of roving. - Configures the tension control related parameters.	5.1.8
	Bobbin package configuration PACKAGE	• Bobbin package configuration screen - Specifies the shoulder angles, lift length, and stop position. - Specifies the number of layers and (Delta of package diameter)	5.1.9

Top menu	Sub menu	Screen description	Related section
Setting up of functions FUNCTION	User setting USER	• Customizing screen for user preferences · Customizes the display items and units in the customizable area of the main (home) screen. · The display items in the customizable area of the main (home) screen. · Makes the indicator lamp (tower lamp) setting. · Sets up the key lock to protect certain screens and the password lock for roving conditions. · Changes passwords. DISPLAY LAMP PROTECT PASSWD	5.1.10
	Utility UTILITY	• Utility screen · Configures the sliver change setup function. · Configures the scheduled doffing. SLIVER SCHEDULE DOFFING	5.1.11
	Initial setting INIT	• Initial setting screen for initial setting up and adjustment · Configures parameters. · Adjusts the winding start position and doffing position. · Adjusts the bobbin rail zero point. · Adjusts the tension level origin. PARAM DOFFING RAIL INIT TENS INIT OTHER	5.1.12
	Device setting DEVICE	• Device setting screen for blow cleaner and automatic greasing · Sets up the blow cleaner and CWC unit. · Specifies the automatic greasing interval and greasing periods. GREASE CLEANER	5.1.13
	Memory MEMORY	• Memory function screen · Allows saving and reading of the FL settings, production info, and maintenance info into/from a memory card. · Allows temporary saving and reading of settings currently in use. CARD FL MEMORY	5.1.14 5.1.15 [2]
	Machine information INFO	• FL information screen · Displays a list of settings. · Displays the information of other FLs on the network. LIST R.INFO	5.1.15 [1]
	Dedicated to manufacturer MAKER	• TOYODA-dedicated screen · Switches the display languages between the local one and English.	

5.1.17 List of Setting Values

The table below lists the function menu and the setting values.

Setting change: 1: Possible when the FL is running 2: Possible any time if the FL is stopped 3: Possible only in the full-bobbin stop state

Top menu	Menu screen	Sub menu	Page	Symbol	Name	Unit	Min value	Max value	Initial value	Setting change
FUNCTION	BASIC		Basic roving conditions	R	Product code (ID)		0 char	10 chars	0 char	3
				M	Material		Selectable		Carded	3
				G	Roving thickness (weight)	Selectable	30	700	200[gr/30yd]	3
				P	Presser winding	turn	2	4	3	3
				LL	Full-bobbin length	Selectable	100	90000	2000[m]	3
				TW	Number of twists	Selectable	0.250	3.000	1.400[tpi]	3
				SG	Sliver weight	Selectable	20	1700	310	3
				NF	Mean flyer speed	rpm	-	-	-	3
				f	Flyer speed change		MANUAL	AUTO	AUTO	3
				f	Mean flyer speed	rpm	600	1500	1000	3
				f	Manual flyer speed (0 to 100 %, 11 levels)	rpm	500	1500	1000	3
		SLIVER		S	Sliver name		0 char	10 chars	0 char	3
				SL	Sliver length	Selectable	100	90000	2000[m]	3
				SW	Sliver change warning		OFF	ON	OFF	3
				SC	Number of sliver change setups		1	10	1	3
			Mechanical adjustment screen 1	MTD	Total draft change gear (T.D.C.)	T	20	80	44	3
				MBD	Brake draft change gear (B.D.C.)	T	40	80	61	3
				MTG	Tensor gauge		Selectable		DLC26	3
				MFC	Front collector	mm	3	14	3	3
				MCD	Condenser	mm	8	18	8	3
				MSG	Sliver guide	mm	Selectable		11 × 3.5	3
			Mechanical adjustment screen 2	MRG1	Roller gauge: Front-2nd	mm	0.0	99.9	0.0	3
				MRG2	Roller gauge: 2nd-3rd	mm	0.0	99.9	0.0	3
				MRG3	Roller gauge: 3rd-Back	mm	0.0	99.9	0.0	3
				MAW1	Arm loads: Front	kg	Selectable		12	3
				MAW2	Arm loads: 2nd	kg	Selectable		20	3
				MAW3	Arm loads: 3rd	kg	Selectable		15	3
				MAW4	Arm loads: Back	kg	Selectable		15	3
			Production data entry	PSP	Number of spindles for production		0	144		1
				PEf	Efficiency for forecast of doffing	%	1	100	80%	1
	FL	FL	Inching	NI0	Ultra slow speed	rpm	10	100	20	2
				aI0	Ultra slow angle	deg	0	720	180	2
				NI1	Slow speed	rpm	10	400	300	2
				tI1	Slow time	sec	5	99	15	2
				NI2	High speed	rpm	300	600	600	2
			Automatic winding	AWsw	Automatic winding operation		OFF	ON	ON	2
				NA0	In reverse rotation: Winding count	rpm	10	150	100	2
				cA0	Reverse count for reverse rotation	turn	1.0	5.0	2.0	2
				lA0	Winding length for reverse rotation	mm	0	300	100	2
				twA0	In reverse rotation: Number of twists	To be set	0.25	3.00	1.25[rpm]	2
				NA1	Flyer winding speed	rpm	50	500	300	2
				tA1	Winding time	sec	3	30	5	2
			Start	NB1	Prevention of bobbin jumping (Bobbin jumping prevention speed)	rpm	600	1200	800	2
				cB1	Prevention of bobbin jumping (Number of layers)	layer	0	20	0	2
				TFB1	Prevention of bobbin jumping (Roving tension)	mm	0.01	1.00	0.80	2

Top menu	Menu screen	Sub menu	Page	Symbol	Name	Unit	Min. value	Max. value	Initial value	Setting change
			Stop 1	SSR	Flyer speed rate for prevention of stop at bobbin shoulders	%	50	100	100	2
				DEC1	Flyer deceleration rate 1	rpm/s	100	250	200	2
				DEC2	Flyer deceleration rate 2	rpm/s	75	150	110	2
				IRL	Prevention of thin roving (1), Looseness for stop	mm	0	50	7	2
				NPTR	Prevention of thin roving (2), Looseness start rpm	rpm	0	1000	0	2
				PTRR	Prevention of thin roving (2), Looseness winding rate		70	100	100	2
			Stop 2	NFB	At full-bobbin stop. Flyer speed	rpm	10	200	70	2
				cFBtw	At full-bobbin stop. Additional twists	turn	0	30	0	2
				lFBtw	At full-bobbin stop. Roving delivery after additional twisting	mm	0	500	0	2
				lFBbr	At full-bobbin stop, Roving looseness by bobbin reverse rotation	mm	0	300	50	2
				aFBf	At full-bobbin stop. Flyer stop angle	deg	0	359	0	2
			Bunch winding (option)	Zsw	Bunch winding function			Selectable		2
				LZ0	Start position	mm	0	450		2
				ZDIR	Start direction		EVEN	ODD	EVEN	2
				LZZ	Bottom bunch position	mm	26	150	26	2
				cZZ	Number of bunch windings	turn	0	5	2.0	2
				ZSPD	Rail speed ratio		0.1	1.00	0.40	2
				cZ0tw	Number of additional twists before bunch winding		0	30	0	2
				lZ0tw	Roving length after additional twisting	mm	0	1000	0	2
				ZSOF	Shoulder offset	mm	0	20	10	2
	TENSION	TENSION	Tension control	TFsw	Tension control		OFF	ON	ON	2
				TFA	Average target tension (display only)	mm	-	-	-	2
				T	Target tension		MANUAL	AUTO	AUTO	2
				T	Target tension specification in MANUAL mode (10 to 100 %, 10 levels)	mm	0.00	2.00	0.81	2
				TFCF	Tension correction for tight tense	×Gain	1.0	3.0	1.0	2
				TFGf	Tension parameter	gf	0.1	100.0	12.0	2
				TFMM	Tension discrimination factor	× mm	0.0	10.0	3.3	2
	PACKAGE	PACKAGE	Bobbin package	AGsw	Shoulder angle mode		MANUAL	AUTO	AUTO	3
				ANGL	Shoulder angle	deg	20	38	32	3
				LT	Lift length	mm	100	420	340	3
				MARGN	Winding margin	mm	20	100	32	3
				LF	Full-bobbin stop position	mm	100	250	170	3
				LAYsw	Selection of layer mode		MANUAL	AUTO	AUTO	3
				LAYER	Number of layers	[illegible]	0.00	99.99	8.38[cpi]	3
				DPH	Δ φ	mm	-	-	-	3
				T	Δ φ mode		Selectable		ACTIVE	3
				T	Δ φ specification in MANUAL mode (10 to 100 %, 10 levels)	mm	0.10	2.00	0.80	3
			Bobbin shape	BL	Bobbin length	mm	300	452	452	3
				DBOB	Bobbin diameter	mm	40.0	60.0	45.0	3
	USER	DISPLAY	Unit	U0	Roving length		Selectable		m	1
				U1	Production		Selectable		m	1
				U2	Number of twists		Selectable		TPI	1
				U3	Coil		Selectable		CPI	1
				U4	Roving thickness		Selectable		gr/30m	1
			Display	FL	FL name		0 char	6 chars	0 char	1
				DP0	Delivery condition display: Materia		HIDE	SHOW	SHOW	1
				DP1	Delivery condition display: Thickness		HIDE	SHOW	SHOW	1
				DP2	Delivery condition display: Twists		HIDE	SHOW	SHOW	1

Top menu	Menu screen	Sub menu	Page	Symbol	Name	Unit	Min. value	Max. value	Initial value	Setting change
				DP3	Warning display, Maintenance warning		HIDE	SHOW	SHOW	1
				DP4	Warning display, Sliver change warning		HIDE	SHOW	SHOW	1
				DP5	Total of roving breaks		HIDE	SHOW	SHOW	1
		LAMP	Indicator lamp (Tower lamp)	LP1	Normal stop		Selectable		Red, ON	1
				LP2	Trouble stop		Selectable		Red, flash	1
				LP3	Sliver break		Selectable		Green, ON	1
				LP4	Sliver change		Selectable		Green, flash	1
				LP5	Roving break		Selectable		Yellow, ON	1
				LP6	Break at middle		Selectable		Yellow, flash	1
				LP7	Full bobbin		Selectable		White, ON	1
				LP8	Bobbin loading position		Selectable		White, flash	1
		PROTECT	Key protection	KP1	Tension level adjustment		OFF	ON	OFF	1
				KP2	Shift counter change		OFF	ON	OFF	1
				KP3	Shift counter clear		OFF	ON	OFF	1
				KP4	Half doffing		OFF	ON	OFF	1
				KP5	Manual lifting		OFF	ON	OFF	1
				KP6	Manual delivery function		OFF	ON	OFF	1
				KP7	Protection on main (home) screen		OFF	ON	OFF	1
				KP8	CWC mode change		OFF	ON	OFF	1
				KP9	Cleaner mode change		OFF	ON	OFF	1
				KP10	Doffer mode change		OFF	ON	OFF	1
			Password protection	PP	Change roving setting		OFF	ON	OFF	1
		PASSWD			Change password		4 digits		1414	1
	UTILITY	SLIVER	Sliver exchange	SCc1	Exchange Doff., Z1		0	50	0	2
				SCc2	Exchange Doff., Z2		0	50	0	2
				SCc3	Exchange Doff., Z3		0	50	0	2
				SCc4	Exchange Doff., Z4		0	50	0	2
				SCc5	Exchange Doff., Z5		0	50	0	2
				SCl1	Remain at exchange Z1	Selectable	0	100	0[m]	2
				SCl2	Remain at exchange Z2	Selectable	0	100	0[m]	2
				SCl3	Remain at exchange Z3	Selectable	0	100	0[m]	2
				SCl4	Remain at exchange Z4	Selectable	0	100	0[m]	2
				SCl5	Remain at exchange Z5	Selectable	0	100	0[m]	2
				SCD	Doffing count		0	50	0	2
		SCHEDULE DOFFING	Scheduled doffing	SDl1	Full len., setup 1	Selectable	0	90000	0[m]	2
				SDl2	Full len., setup 2	Selectable	0	90000	0[m]	2
				SDl3	Full len., setup 3	Selectable	0	90000	0[m]	2
				SDl4	Full len., setup 4	Selectable	0	90000	0[m]	2
				SDc1	Doff. count. setup 1		0	100	0	2
				SDc2	Doff. count. setup 2		0	100	0	2
				SDc3	Doff. count. setup 3		0	100	0	2
				SDc4	Doff. count. setup 4		0	100	0	2
				SDcD	New Doff. count		0	400	0	2
		PARAM	Parameter 1	NFm	NF data base mode		MANUAL	AUTO	AUTO	3
				NFf	Flyer speed at max. diameter	rpm	600	1200	900	3
				DDBm	Delta Phi data base mode		Selectable		LEARN	3
				DDBMa	Param. (a)		0.0100	1.0000	0.0640	3
				DDBMb	Param. (b)		0.100	0.900	0.500	3
				k2	Winding offset value	%	0.0	7.0	2.0	3

Top menu	Menu screen	Sub menu	Page	Symbol	Name	Unit	Min. value	Max. value	Initial value	Setting change
		DOFFING	Rail position	L5	Winding start position	mm	65	500	110	2
				L0	Over-down position	mm	0	196	42	2
				L1	Empty-bobbin loading position	mm	0	15	7	2
				LR	Removal position from FRD(option)	mm	0	50	2	2
				LI	Insertion position into FRD (option)	mm	0	50	2	2
			Bobbin detection (option)	NBCK	Bobbin speed		10	300	300	2
				tBCK	Detection time		0	10	5	2
		RAIL INIT	Bobbin rail zero point		Bobbin rail zero point		-	-	-	2
		TENS INIT	Tension level origin		Tension level origin		-	-	-	2
		OTHER	Frame information	MFG	MFG No.	-	0	999999	0	2
				Sn	Specification No.	-	0 character	16 characters	0 character	2
				Un	User name	-	0 character	16 characters	0 character	2
			Others	SLC	Constant length offset		OFF	ON	ON	2
				FAS	Flyer angle stop		OFF	ON	ON	2
				ISC	Inching operation upon empty bobbin		Run	Stop	Run	2
				lFLE	Fleece length	mm	500	2000	1400	2
				ACCM	Acceleration for individual motor drive	rpm/s	50	250	250	3
				WDW	Forced writing of bobbin package diameter		OFF	ON	OFF	2
				Wdia	Bobbin package diameter to be written	mm	40.0	180	45.0	2
				tFSC	Flyer cover check time (Option)	sec	0.1	5.0	1.0	2
	DEVICE	GREASE	Greasing system	tGFc	Greasing interval for flyer gears	hour	10	200	60	1
				tGBc	Greasing interval for bobbin gears	hour	10	200	60	1
				tGau	Lubrication time (Motor driving time) for automatic greasing	min	1	99	6	1
				tGma	Lubrication time (Motor driving time) for manual greasing	min	1	99	6	1
		CLEANER	Cleaning devices	tCWC1	CWC, Dumper interval	hour	1	100	15	1
				tCWC2	CWC, Dumper open time	sec	1	60	5	1
				lBC1	Cleaner, Delay start delivery length	m	0	500	10	1
				tBC2	Cleaner, Stop time	min	0	30	5	1
				lBC2	Full-bobbin prediction length	m	0	9999	50	1

Section 6.1
Roving

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6.1 Roving

6.1.1 Test Run and Checking Items

(1) First test roving

At the first stage of a test run, perform roving using a total of 10 spindles or more--6 spindles at the GE, 2 spindles at the middle, and 2 spindles at the OE.

Sliver and others required for the test run should be prepared beforehand.

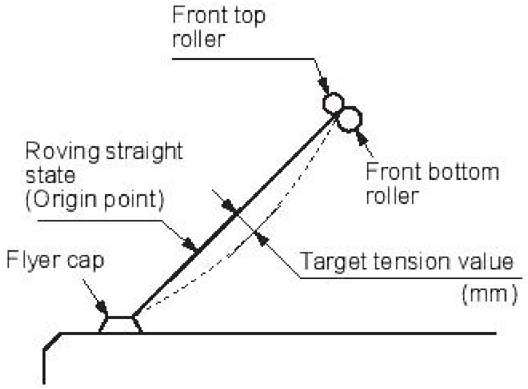
Run the FL, check the following points, and make necessary adjustments if any problem is found, for satisfying the roving conditions specified by the customer.

1) Traveling state of sliver fed to the back rollers
2) Relationship between the top rollers and bottom rollers, and the revolution state of the aprons
3) Operation of the top clearers and bottom clearers
4) Roving tension of roving (after roving up to the full-bobbin length specified by the customer)
5) Shape of bobbins wound up to full
6) Significant difference between roving produced at the GE, at the middle, and at the OE
7) Roving number count, strength, and quality

(2) Second test roving
At the second stage, perform roving using all of the spindles.
Run the FL, check the points listed above again, and make necessary adjustments if any problem is found. Then, proceed to the practical roving operation.

6.1.2 Adjusting the Roving Tension

Roving State between Front Rollers and Flyer Caps


Front top roller
Roving straight state (Origin point)
Front bottom roller
Flyer cap
Target tension value (mm)

To control the roving tension, the FL200 is equipped with the tension controller which detects the roving position between the front rollers and flyer caps and optimizes the roving tension.

The controller's microprocessor automatically applies the measured roving position as an absolute value into its integrated tension control table of optimum tension values relative to the roving conditions in order to calculate the optimum target tension value*.

The automatically calculated target tension value is constant from the start of winding up to the end.

* Target tension value
The target tension value refers to the slack of roving measured from the straight state (origin point) preset in Section 3.1, Subsection 3.1.3 [6]. The greater the target tension values, the greater the roving slack.

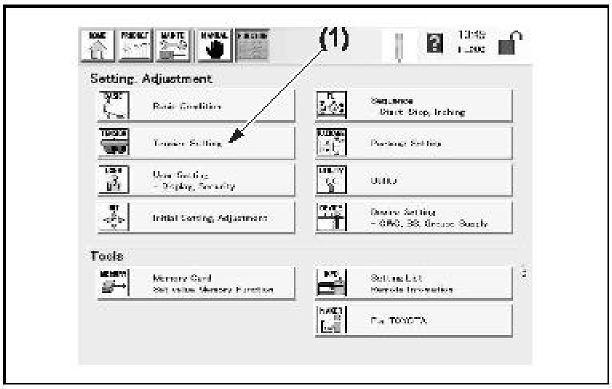
This way, the tension controller automatically determines target tension values, so it is not necessary to enter target tension values from the operation panel.

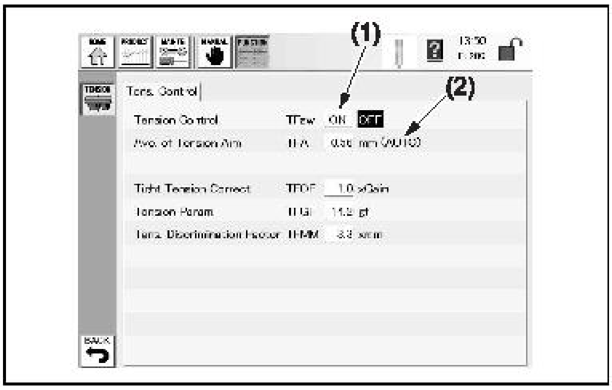
However, to set arbitrary target tension values other than automatically selected ones or to modify target tension values depending upon the wound percentage, you may set the desired values from the operation panel. Refer to Subsections [1] and [2].

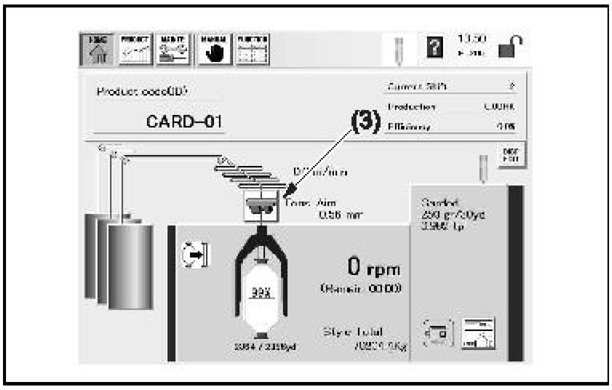
If you turns off the tension controller, you should make other adjustments described in Subsection [3].

[1] To Set Arbitrary [Automatic] Target Tension

You can set arbitrary constant target tension by increasing or decreasing an automatically selected constant target tension value according to the steps below.


(1)
Setting. Adjustment
Basic Condition
Sequence
Start, Stop, Inching
Tension Setting
Package Setting
User Setting
- Display, Security
Utility
Initial Setting, Adjustment
Device Setting
Tools
Memory Card
Set value Memory Function
Setting List
Remote Information
For TOYOTA


(1)
(2)
Tens. Control
Tension Control
TTsw
ON
OFF
Avg. of Tension Aim
0.56 mm (AUTO)
Tight Tension Correct
1.0 xGain
Tension Param.
Tens. Discrimination Factor
BACK


Product code(ID)
CARD–01
Production
Efficiency
(3)
Tens. Aim
0.56 mm
0 rpm
Style Total

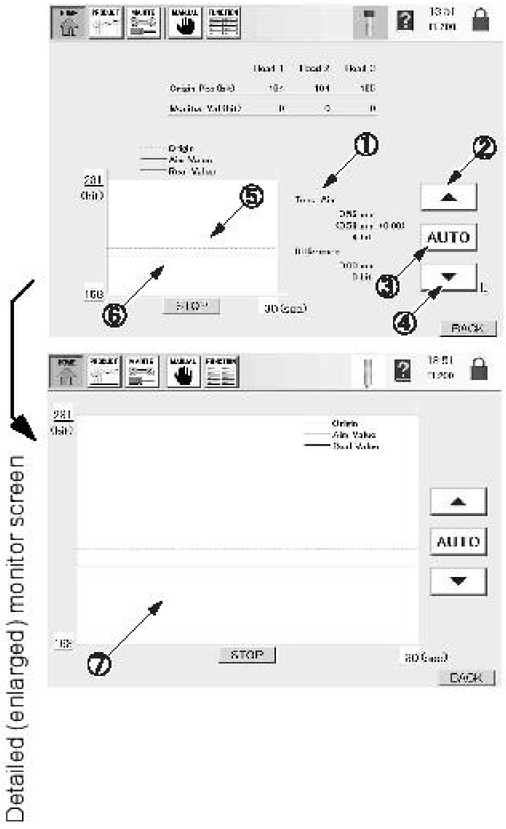
(1) Select the "ON" box for the Tension Control within the FUNCTION screen.

(2) Set the Average Tension Aim to "AUTO".

(3) Return to the main screen and touch the "Tension Aim" key.

(4) Use the up- and down-arrow keys [↑] [AUTO] [↓] on the Tension Control screen to increase and decrease the automatically selected target tension value, respectively.

REFERENCE: If you have set the Average Tension Aim in item (2) above to "Manual" then the up and down-arrow keys as well as the Auto key cannot be used to set the tension.


MANUAL
FUNCTION
Head 1
Head 2
Head 3
Origin
Aim Value
Real Value
281
(bit)
168
STOP
30 (sec)
AUTO
BACK
①
②
③
④
⑤
⑥
⑦
Detailed (enlarged) monitor screen

① Target tension value
(which will vary depending upon the roving conditions and arbitrary setting)

② To decrease the target value for tensioning roving.
(In units of 0.05 mm)

③ To restore the automatically calculated value after modifying it.

④ To increase the target value for slacking roving.
(In units of 0.05 mm)

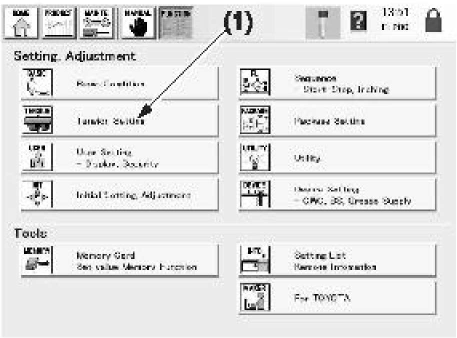
⑤ Monitored roving position (which can show the last 10-second transition.)

⑥ Touching any position in the frame calls up the detailed monitor screen.

Touching any position in the frame returns to the previous screen.

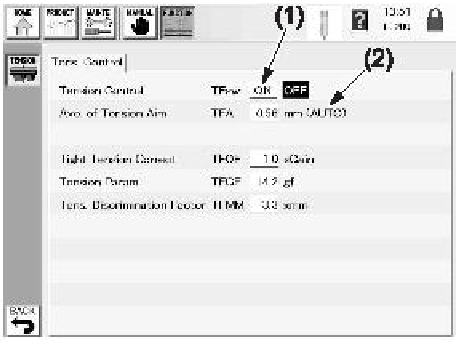
[2] To Set Arbitrary [Manual] Target Tension

To set an arbitrary variable target tension, enter tension values at 10 wound-percentage stages (0, 10, 20,..., 90, and 100%) according to the steps below.
If the full-bobbin length is 4000 m, you may vary the target tension at 400-m intervals.

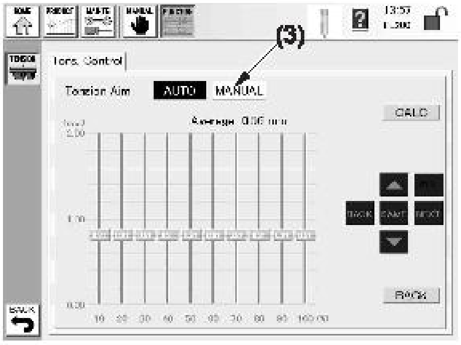

(1)
Setting, Adjustment
Basic Condition
Sequence - Start, Stop, Inching
Tension Setting
Package Setting
User Setting - Display, Security
Utility
Initial Setting, Adjustment
Device Setting - CMC, SS, Grease Supply
Tools
Memory Card Set value Memory Function
Setting List Remote Information
For TOYOTA

(1) Select the "ON" box for the Tension Control within the FUNCTION screen.

(2) When you touch the Average Tension Aim value box, a screen will appear that allows you to set the Tension Aim values for each of the 10 wound-percentage stages.


(1)
(2)
Tens. Control
Tension Control TFsw ON OFF
Avg. of Tension Aim TFA 0.56 mm (AUTO)
Tight Tension Correct. TFCH 1.0 xGain
Tension Param. TFCF 14.2 gf
Tens. Discrimination Factor H.MM 3.3 mm
BACK

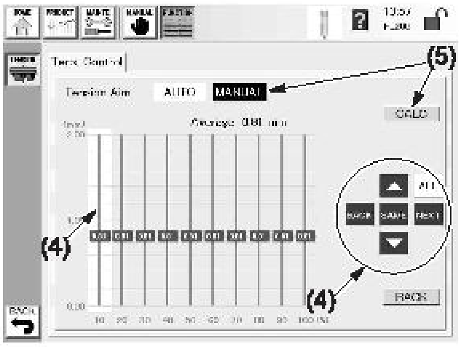
(3) When the Tension Aim is set to "Manual" the slide bars and buttons will make it possible to set the Tension Aim for each of the 10 wound-percentage stages.


(3)
Tens. Control
Tension Aim AUTO MANUAL
Average
CALC
BACK SAME NEXT
BACK
10 20 30 40 50 60 70 80 90 100 (%)

(4) Touch the slide bar of the wound-percentage stage that you wish to change the Tension Aim value for. (If you wish to change the value in 0.01 mm units, use the up and down triangle arrow keys.)

NOTE: If you press the SAME key you can copy the Tension Aim value from the previous wound-percentage stage.

NOTE: If you press the ALL key then all of the wound-percentage stages will be selected and you can adjust the Tension Aim values for all the stages at the same time.

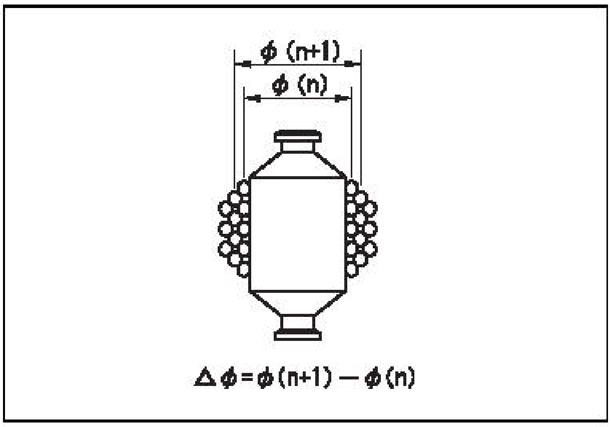

(5)
(4)
(4)
Tens. Control
Tension Aim AUTO MANUAL
Average
CALC
ALL
BACK SAME NEXT
BACK
10 20 30 40 50 60 70 80 90 100 (%)

(5) After changing the Tension Aim values for each wound-percentage stage, if you press the CALC key, then the average aim value for one doffing will be calculated.

REFERENCE:

- It is possible to set the Tension Aim values in units of 0.01 mm when setting the values for each wound-percentage stage.
- Excessive change or descending change (from the winding start to the end) in target tension values will have a bad effect on the bobbin shape.

[3] If You Do Not Use the Tension Control (Emergency Response when the Tension Sensors Malfunction)...



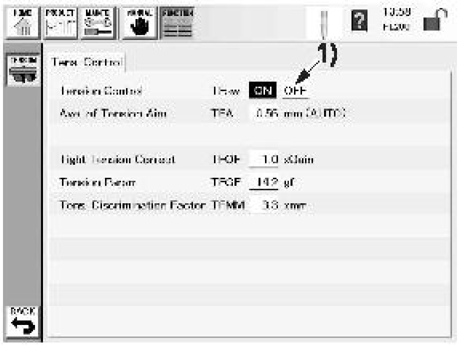
$\Delta\phi = \phi(n+1) - \phi(n)$

One of the factors influencing the roving tension is an increase in package diameter (Delta ø). The Delta ø value represents the increase in the diameter resulting from a further increase in the layers of material on the bobbin. Usually, the FL automatically calculates the optimal Delta ø value according to the roving conditions.

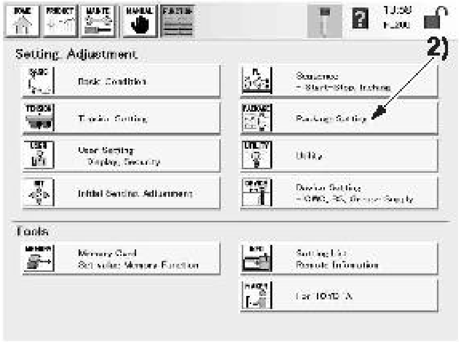
Generally it is not necessary to set the Delta ø value. However, when the FL operates without using the tension controller, it is unable to compensate for external factors (such as temperature and humidity) so in that case you may need to modify this Delta ø value.

(1) Adjusting the increase in package diameter (Delta ø)
Set the Delta ø (Auto value) according to the observed conditions.
If the roving tension seems to be too tight, then increase the Delta ø; if it seems too loose, then decrease the Delta ø value.

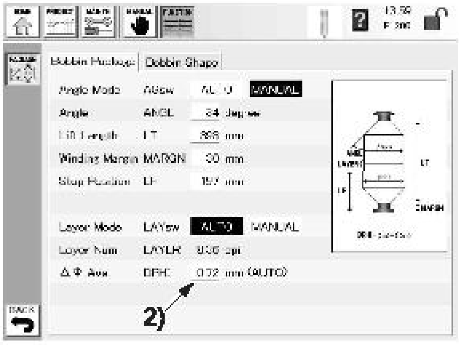
1) Select the "OFF" box for the Tension Control within the FUNCTION screen.

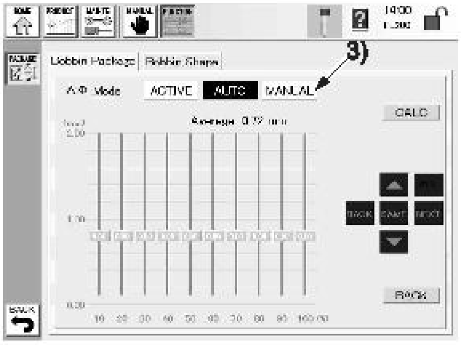


Tension Control TFsw ON OFF
Ave. of Tension Aim TFA 0.56 mm (AUTO)
Tight Tension Correct TFOF 1.0 [illegible]
Tension Param TFGF 14.2 gf
Tens. Discrimination Factor TFMM 3.3 xmm


Setting, Adjustment
Basic Condition
Sequence
Tension Setting
Package Setting
User Setting
Display, Security
Utility
Initial Setting, Adjustment
Device Setting
Tools
Memory Card
Setting List
For TOYOTA
2)

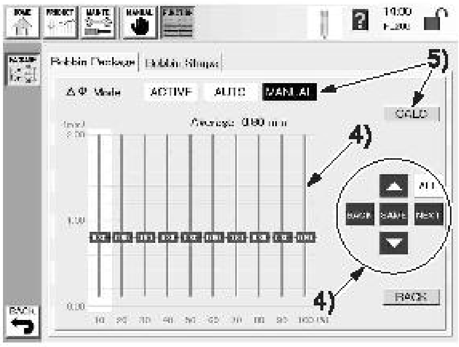
2) On the Function Setting screen you will find the Package Setting box. Touch this to access the Bobbin Package screen. If you touch the Delta ø Average value box another screen will appear where you can set the Delta ø for each wound-percentage stage.


Bobbin Package
Bobbin Shape
Angle Mode
AUTO
MANUAL
Angle
Lift Length
Winding Margin
Stop Position
Layer Mode
AUTO
MANUAL
Layer Num
Δ Φ Ave
(AUTO)
BACK
2)


Bobbin Package
Bobbin Shape
Δ Φ Mode
ACTIVE
AUTO
MANUAL
Average
CALC
BACK
SAME
NEXT
BACK
3)

3) When you select "Manual" for the Delta ø mode it then becomes possible to use the slide bars and buttons to set the Delta ø for each wound-percentage stage.

NOTE: Please only select "Manual" when the tension control is not implemented.
When the tension control is implemented always be sure to select the "Active" setting.


Bobbin Package
Bobbin Shape
Δ Φ Mode
ACTIVE
AUTO
MANUAL
Average
CALC
ALL
BACK
SAME
NEXT
BACK
5)
4)
4)

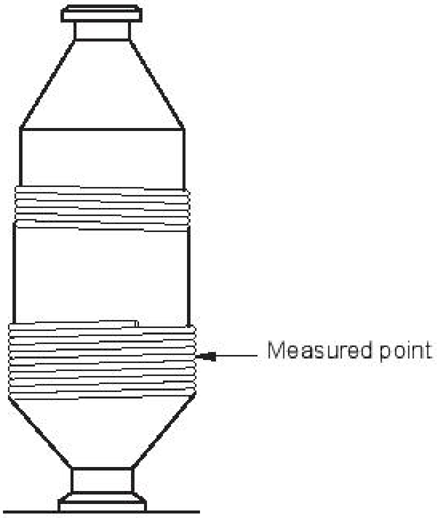
4) Touch the slide bar of the wound-percentage stage that you wish to change the Delta ø value for. (If you wish to change the value in 0.01 mm units, use the up and down triangle arrow keys.)

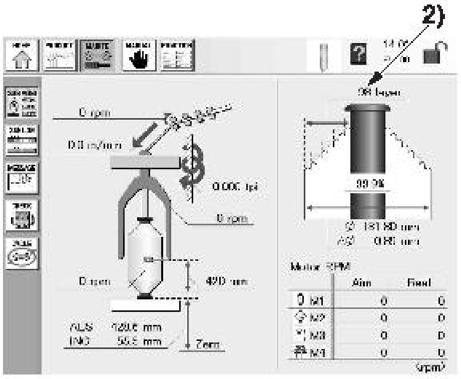
NOTE: If you press the SAME key you can copy the Delta ø value from the previous wound-percentage stage.

NOTE: If you press the ALL key then all of the wound-percentage stages will be selected and you can adjust the Delta ø values for all the stages at the same time.

5) After changing the Delta ø values for each wound-percentage stage, if you press the CALC key, then the average Delta ø value for one doffing will be calculated.

Roving Package at Full-bobbin





(2) Calculating the optimum Delta ø

EXAMPLE: Assuming that the FL spun cotton of 200gr/30 yards with a Delta ø of 0.7 mm (on Active or Automatic) to produce 4000 meters of roving:

1) Measure the diameter of the full-bobbin.

In this example, it is 140 mm.

2) Check the number of layers on the sub-monitor screen.

[Confirmed result] is 126 layers.

3) Calculate the optimum Delta ø value according to the formula below.

$$\text{Delta ø (mm)} = \frac{\text{Dia. of full-bobbin (Measured value)} - \text{Dia. of empty-bobbin (45 mm)}}{\text{Number of layers}}$$

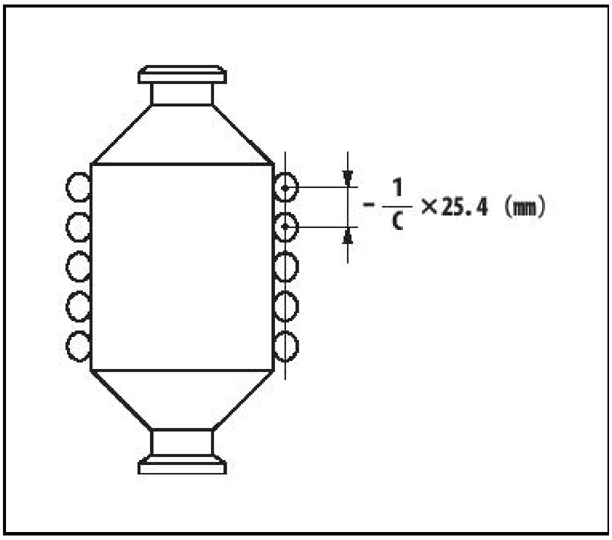
$$= \frac{140 - 45}{126}$$

$$= 0.735$$

4) Set the Delta ø to be 0.74 (mm) on the Delta ø manual setting screen.

REFERENCE:

- You may set the Delta ø values for each wound-percentage stage in units of 0.01 mm.
- Excessive change to the set Delta ø values or setting descending Delta ø values from the winding start to the winding end (which as explained previously will lead to a very tight tension setting) will have an adverse effect on the bobbin shape.



6.1.3 Setting the Number of Layers

The number of layers refers to the number of coils per 25.4-mm bobbin lift. The FL automatically calculates the optimum number of layers according to the Bogdan formula given below. Therefore, you do not need to set the number of layers. In order to set the arbitrary number of layers, you may enter it from the operation panel.

NOTE: Please refer to Section 5 for the method to carry out a change to the set number of layers.

Bogdan formula

$$C = 8.365 \times N^{0.6617} \qquad N = \frac{250}{W}$$

C: Number of coils per 25.4-mm bobbin lift

N: Hank roving

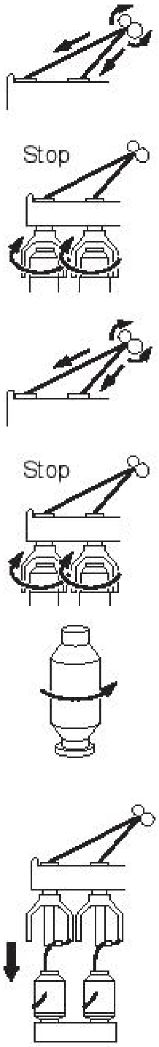
W: Roving weight (g) per 30 yards

6.1.4 Adjusting the Automatic Roving Cutting Operation

Generally it is well known that the longer the staple length, the more the roving cutting faults such as roving cut between the front rollers and the flyer caps or roving slip-out inside the flyer pipes, which cannot be covered by only the ordinary down-movement of the bobbin rail.
As a solution for those cutting problems, this machine partially gives more twists than usually to roving between the front rollers and the presser paddles at the full-bobbin state in order to increase the roving strength, thereby preventing roving slip-out during the down-movement of the bobbin rail and making possible the automatic roving cutting in the proper position (at the presser paddles).
However, the roving cutting state will vary depending upon the fiber type, the number of twists, and other roving conditions, so it is necessary to make some adjustments described in this section.

[1] Operation Sequence of Automatic Roving Cutting

The operation sequence at the time of full bobbin stop is shown below.



○:Rotating ×:Not rotating

(Steps ① through ③ below are called "Hard-twisting operation.")	Front rollers	Flyers	Winding operation	Related set values
Full-bobbin deceleration ↓	○	○	○	
① Addition twists ↓	×	○	×*1	X^2: Number of additional twists (turns)
② Roving feed ↓	○	○	○	X^3: Roving feed amount (mm)
③ Slacking ↓	×	○	×*1	X^1: At the time of automatic winding, only the amount of slack needed to compensate for the reverse rotation of the flyers is twisted further.
④ Reverse rotation of bobbins ↓	×	×	Reverse*2	X^4: Reverse bobbin feed amount (mm)
Down-movement of bobbin rail	—	—	—	

NOTE:
*1 "No" in the winding column means that the flyers and bobbins rotate at the same speed. It does not mean the stop of bobbins.
*2 "Reverse" in the winding column means that only bobbins rotate in the reverse direction.

NOTE: Due to the independent motor that provides drive power to the drafting parts, normally steps ① and ③ will be enabled. (The drafting motor will be stopped during the hard-twisting operation.)

[2] Adjusting the Automatic Roving Cutting Items

(1) Adjust the automatic roving cutting items in the order of "Roving feed amount following hard-twisting," "Number of additional twists," and "Reverse bobbin feed amount.

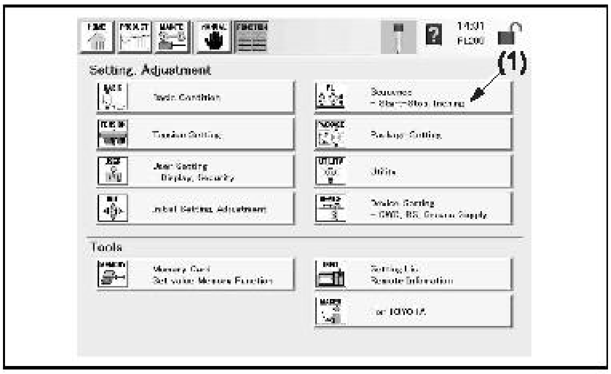
(2) Allowable modification values per adjustment step are as follows:

Roving feed amount following hard-twisting:	Approx. 10 mm
Number of additional twists:	3
Reverse bobbin feed amount:	Approx. 5 mm

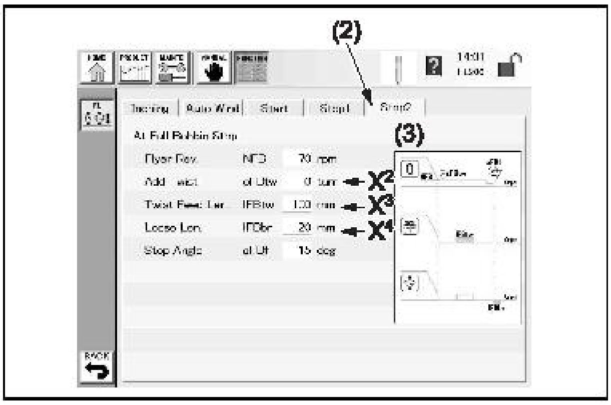
Set items / Roving cut state	Reverse bobbin feed amount (mm)	Number of additional twists	Roving feed amount following hard-twisting (mm)	Full-bobbin stop position (mm)
Roving cut between the front rollers and the flyer caps	—	Increase the set value.	Decrease the set value.	Stop the FL so that the winding point is as low on the roving package as possible. (**NOTE:** If the bobbin diameter at full-bobbin state is small, automatic roving cutting may be impossible.)
Roving cut inside the flyer pipes	—	Increase the set value.	Increase the set value.	
Roving cut length too long	Decrease the set value.	—	—	
Roving cut length too short	Increase the set value.	—	—	
Automatic roving cutting fails. (The roving remains uncut.)	Decrease the set value.	—	—	
Reference value: Polyester Rayon Ne 1.0	20 mm	10 times	50 mm	150 mm (Lift length: 390 mm)

[3] Setting Procedure of Automatic Roving Cutting Items

Setting the "Number of additional twists (X^2)", "Roving feed amount (X^3)", and the "Reverse bobbin feed amount (X^4)" is carried out as shown below.


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
14:01
FL200
(1)
Setting, Adjustment
Basic Condition
Sequence
– Start-Stop, Inching
Tension Setting
Package Setting
User Setting
Display, Security
Utility
Initial Setting, Adjustment
Device Setting
– OMS, BS, General Supply
Tools
Memory Card
Set value Memory Function
Setting List
Remote Information
for TOYOTA

(1) Open the Sequence Screen within the FUNCTION setting screen.


(2)
HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
14:01
FL200
Inching
Auto Wind
Start
Stop1
Stop2
(3)
X2
X3
X4
BACK

At Full Bobbin Stop

Flyer Rev. NFD 70 rpm

Add. twist of Utw 0 turn

Twist Feed Len. IFBtw 100 mm

Loose Len. IFDbr 20 mm

Stop Angle of Uf 15 deg

(2) Selecting the Stop 2 tab will cause the full bobbin stop setting change screen to appear.

(3) Touch the setting value boxes in order to enter the values.

6.1.5 Roller Parts Setting Range

[1] FL200 Main Specifications and Setting Range

Staple length		22 to 40 mm		40 to 51 mm		51 to 76 mm		44 to 76 mm[*1]	
Drafting system		4-roller (D type)		4-roller (D type)		3-roller		3-roller	
Weighting arm	Manufacturer	Texparts		Texparts		Texparts		Texparts	
	Type	PK 1500-001938		PK 1500-001938		PK 1500-02		PK 1500-02	
Weight (kg per 2 spindles)	F	9 – 12 – 15		9 – 12 – 15		20 – 25 – 30		20 – 25 – 30	
	2	15 – 20 – 25		15 – 20 – 25		10 – 15 – 20		10 – 15 – 20	
	3	10 – 15 – 20		10 – 15 – 20		15 – 20 – 25		15 – 20 – 25	
	B	10 – 15 – 20		10 – 15 – 20		—		—	
Cradle type		OH514-110		OH534-110		OH524-110		OH534-110	
Cradle gauge × width (mm)		31.5 × 40		39.8 × 40		54.3 × 40		39.8 × 40	
Bottom roller diameter (mm)	F	28.5		31.75		31.75		31.75	
	2	28.5		31.75		28.5 (knurled)		28.5 (knurled)	
	3	28.5 (knurled)		28.5 (knurled)		31.75		31.75	
	B	28.5		31.75		—		—	
Top roller diameter (mm)		F, 2, B	28	F, 2, B	30	F, B	35	F, B	35
		3	25	3	25	2	33	2	33
Roller gauge[*2] (mm)	F - B	Max. 193		Max. 193		Max. 185		Max. 185	
	Apron zone	2 - 3	min 47	2 - 3	min 60	F - 2	min 73	F - 2	min 62
Cradle radius (R)		34.5		45.0		58.0		45.0	

[*1] Cradles for staple length of 51 to 76 mm should be ordered separately.

[*2] The roller gauge denotes the set gage range at the middle section of the FL. The set gage range between rollers differs depending upon the specifications.

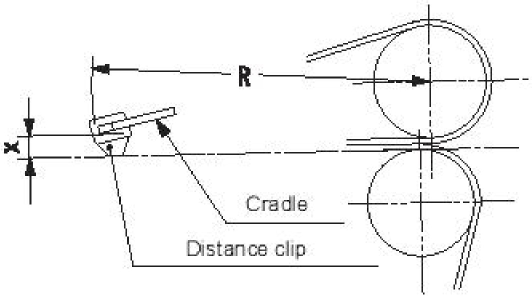
[2] Choosing the Distance Clips

You should choose distance clips according to the fiber type, spun grain, thickness of aprons, draft amount at aprons, and draft distribution.

(1) If the gauge is too narrow, fiber-clogged or kinky roving will result.

(2) If the gauge is too wide, the FL cannot control fly effectively, offsetting the advantages of the apron draft.

Opening Distance “X” of OLc-type Distance Clip on SKF Weighting Arms



Distance “X”   Unit: mm

Tenser gage	OLC22	OLC24	OLC25	OLC26	OLC27	OLC28
Color	White	Black	Beige	Green	Blue	Brown
Grain range Cradle type	– 150/30	140/30 – 220/30	190/30 – 270/30	240/30 – 320/30	300/30 – 380/30	350/30 –
OH514	3.5	4.5	5.4	6.5	9.3	12.1
OH534*	3.6, 3.3	4.6, 4.3	5.4, 5.0	6.5, 6.1	9.2, 8.8	12.0, 11.5
OH524	3.3	4.3	5.0	6.1	8.7	11.3

* The apron roller diameter of the OH534 is 25 for the LH side and 33 for the RH side.

[3] Selecting the Front Collectors, Condensers, and Sliver Guides for Three-roller Apron Drafting System

Drafting system	Sliver g/m gr/6yd	Spun roving (g/m)	0.826 to 0.767	0.767 to 0.708	0.708 to 0.649	0.649 to 0.590	0.590 to 0.531	0.531 to 0.472	0.472 to 0.413	0.413 to 0.354	0.354 to 0.295	0.295 to 0.236
		Spun roving (g/30yd)	350 to 325	325 to 300	300 to 275	275 to 250	250 to 225	225 to 200	200 to 175	175 to 150	150 to 125	125 to 100
		Parts	Opening (mm)									
Three-roller apron draft	2.36 to 2.95	Front collector					12	11	10	9 to 10	8 to 9	7 to 8
	200 to 250	Condenser					12	12	12	12	12	12
		Sliver guide					11 × 3.5	11 × 3.5	11 × 3.5	11 × 3.5	11 × 3.5	11 × 3.5
	2.95 to 3.54	Front collector				12	12	11	10	9 to 10	8 to 9	7 to 8
	250 to 300	Condenser				12	12	12	12	12	12	12
		Sliver guide				13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5
	3.54 to 4.13	Front collector			14	12	12	11	10	9 to 10	8 to 9	7 to 8
	300 to 350	Condenser			15	15	15	15	15	15	15	15
		Sliver guide			15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5
	4.13 to 4.72	Front collector		14	14	12	12	11	10	9 to 10	8 to 9	
	350 to 400	Condenser		15	15	15	15	15	15	15	15	
		Sliver guide		15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	
	4.72 to 5.31	Front collector	14	14	14	12	12	11	10	9 to 10		
	400 to 450	Condenser	15	15	15	15	15	15	15	15		
		Sliver guide	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4		
	5.31 to 5.90	Front collector	14	14	14	12	12	11	10			
	450 to 500	Condenser	15	15	15	15	15	15	15			
		Sliver guide	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4			

NOTE: When using bulky synthetic sliver (e.g., acrylic and rayon), select condensers and sliver guides wider than those specifications given in the above table. For their widths, refer to Subsection [5].

[4] Selecting the Front Collectors, Condensers, and Sliver Guides for Four-roller D-type Apron Drafting System

Drafting system	Sliver g/m gr/6yd	Spun roving (g/m)	0.826 to 0.767	0.767 to 0.708	0.708 to 0.649	0.649 to 0.590	0.590 to 0.531	0.531 to 0.472	0.472 to 0.413	0.413 to 0.354	0.354 to 0.295	0.295 to 0.236
		Spun roving (g/30yd)	350 to 325	325 to 300	300 to 275	275 to 250	250 to 225	225 to 200	200 to 175	175 to 150	150 to 125	125 to 100
		Parts	Opening (mm)									
Four-roller D-type apron draft	2.36 to 2.95	Front collector					5	5	4	4	4	3 to 4
		Condenser					12	12	12	12	12	12
	200 to 250	Sliver guide					11 × 3.5	11 × 3.5	11 × 3.5	11 × 3.5	11 × 3.5	11 × 3.5
	2.95 to 3.54	Front collector				5 to 6	5	5	4	4	4	3 to 4
		Condenser				12	12	12	12	12	12	12
	250 to 300	Sliver guide				13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5	13 × 3.5
	3.54 to 4.13	Front collector			6	5 to 6	5	5	4	4	4	3 to 4
		Condenser			15	15	15	15	15	15	15	15
	300 to 350	Sliver guide			15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5
	4.13 to 4.72	Front collector		6	6	5 to 6	5	5	4	4	4	
		Condenser		15	15	15	15	15	15	15	15	
	350 to 400	Sliver guide		15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	15 × 3.5	
	4.72 to 5.31	Front collector	6 to 7	6	6	5 to 6	5	5	4	4		
		Condenser	15	15	15	15	15	15	15	15		
	400 to 450	Sliver guide	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4		
	5.31 to 5.90	Front collector	6 to 7	6	6	5 to 6	5	5	4			
		Condenser	15	15	15	15	15	15	15			
	450 to 500	Sliver guide	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4	17 × 4			

NOTE: When using bulky synthetic sliver (e.g., acrylic and rayon), select condensers and sliver guides wider than those specifications given in the above table. For their widths, refer to Subsection [5].

[5] Sizes of Front Collectors, Condensers, and Sliver Guides

Front collector width (mm)	3, 4, 5, 5.5, 6, 7, 8, 9, 10, 11, 12, 14
Condenser width (mm)	8, 10, 12, 15, 18
Sliver guide width (mm)	11 × 3.5 , 13 × 3.5, 15 × 3.5, 17 × 4, 18 × 8

Section 7.1
Instrumentation

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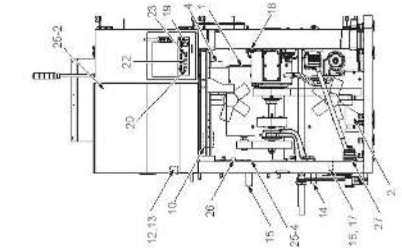
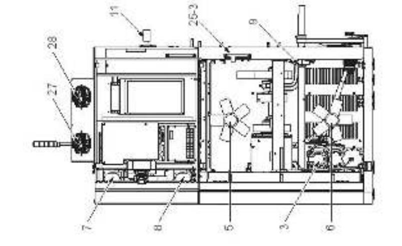
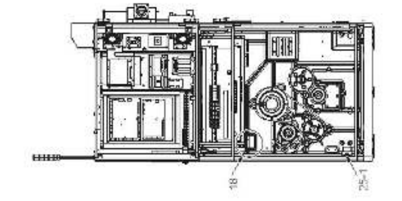
7.1 Instrumentation

7.1.1 Location of Electric Components and Electrical Devices

[1] At GE

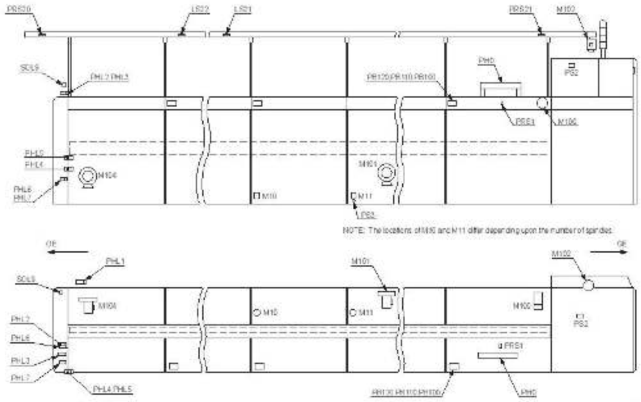






No	Symbol	Parts Name	No	Symbol	Parts Name	No	Symbol	Parts Name
1	M1	Main motor	12	PHR2	Receiver, Roving breakage	22	PB2	Push-button switch, Bobin rail up
2	M2	Winding motor	13	PHR3	Receiver, Roving breakage	23	SS1	Select switch, Data set
3	M3	Lifting motor	14	PHR4	Receiver, Breakage at middle part	25	SW DR1-4	Door switch
4	M4	Drafting motor	15	PHR5	Receiver, Breakage at middle part	25-1	SW DR1	Door switch
5	M5	Fan motor, Gear head	16	PHR6	Receiver, Bobbin misloading	25-2	SW DR2	Door switch
6	M6	Fan motor, Gear head	17	PHR7	Receiver, Bobbin misloading	25-3	SW DR3	Door switch
7	M12	Fan motor (inside box)	18	PS1	Oil pressure switch	25-4	SW DR4	Door switch
8	M13	Fan motor (inside box)	19	PB0	Push-button switch, Emergency stop	26	LS UP	Limit switch, Bobbin rail upper limit
9	PG0	Absolute encoder, Bobbin rail	20	PB1	Push-button switch, Bobin rail down	27	LS DW	Limit switch, Bobbin rail lower limit
10	PG1	Incremental encoder, Flyer	21			28	M14	Fan Motor, Amp heatsink
11	PHR1	Receiver, Sliver breakage				29	M15	Fan Motor, Inverter heatsink

[2] At Middle and OE

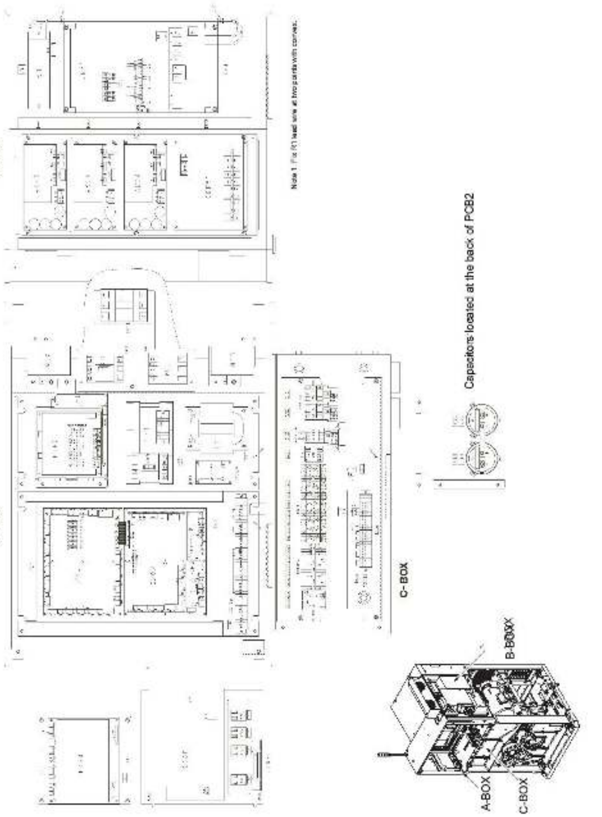

PRS20
LS22
LS21
PRS21
M102
SOL9
PHL2 PHL3
PB120 PB110 PB100
PH0
PS2
PRS1
M100
PHL5
PHL4
M104
PHL6
PHL7
M10
M11
M101
PS3
OE
GE
PHL1
M101
M102
SOL9
M104
M10
M11
M100
PS2
PRS1
PHL2
PHL6
PHL3
PHL7
PHL4 PHL5
PB120 PB110 PB100
PH0

NOTE: The locations of M10 and M11 differ depending upon the number of spindles.

Symbol	Parts Name	Symbol	Parts Name	Symbol	Parts Name
PH0	Tension sensor	PB100	Push-button switch, Start	PRS1	Proximity switch, Flyer stop position
PHL1	Projector, Sliver breakage	PB110	Push-button switch, Inch	PRS20*	Proximity switch, BS at OE
PHL2	Projector, Roving breakage	PB120	Push-button switch, Stop	PRS21*	Proximity switch, BS at GE
PHL3	Projector, Roving breakage	M100	Motor, CWC	SOL9*	Solenoid, Dumper (Dust collector)
PHL4	Projector, Breakage at middle part	M101*	Blower motor	PS2	Pressure switch, Flyer grease
PHL5	Projector, Breakage at middle part	M102*	Motor, Blow cleaner	PS3	Pressure switch, Bobbin gear grease
PHL6	Projector, Bobbin misloading	M104*	Motor, Blow suction	LS22*	Limit switch, BS suction
PHL7	Projector, Bobbin misloading	M10	Pump motor, Flyer grease	LS21*	Limit switch, Blow Cleaner Stop
		M11	Pump motor, Bobbin gear grease		

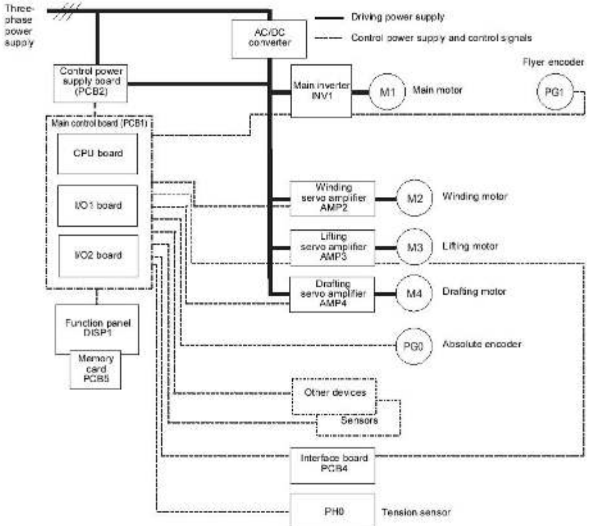
Parts marked with an asterisk (*) are optional.

[3] In the Control Box


B- BOX
Note 1. Fix R1 lead wire at two points with convex.
A- BOX
C- BOX
Capacitors located at the back of PCB2
B-BOXX
A-BOX
C-BOX

7.1.2 Configuration

[1] Major Configurators

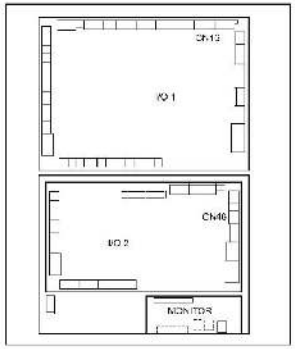

Three-phase power supply
Driving power supply
Control power supply and control signals
AC/DC converter
Control power supply board (PCB2)
Main control board (PCB1)
CPU board
I/O1 board
I/O2 board
Function panel DISP1
Memory card PCB5
Main inverter INV1
M1
Main motor
Flyer encoder
PG1
Winding servo amplifier AMP2
M2
Winding motor
Lifting servo amplifier AMP3
M3
Lifting motor
Drafting servo amplifier AMP4
M4
Drafting motor
PG0
Absolute encoder
Other devices
Sensors
Interface board PCB4
PH0
Tension sensor

The FL uses a main motor (which mainly drives the flyer mechanism), a winding motor (which drives the winding mechanism), a lifting motor (which drives bobbin rails up and down), and a drafting motor (which drives the draft mechanism).

Device name	Symbol	Function
Main control board	PCB1	Consists of the following three boards to control the FL. CPU board: For program execution & operation and communication with the function panel /O1 and I/O2 boards: For communication with each device for input/ output
Control power supply board	PCB2	Generates power required for control. • 5 VDC :CPU power supply • 12 VDC :Power supply for I/O board input • 24 VDC :Power supply for I/O board output • 15 VDC :Analog circuit power supply
Interface board	PCB4	Relays lifting up/down pulse signals.
Function panel	DISP1	Has a color display with a touch panel. The function panel displays the FL control status and monitored state and allows the user to enter settings.
Memory card	PCB5	General-purpose memory card for data storage and reading, and control program downloading **Standard card specification** • CFA standard 64 MB, compact flash memory + PC card with type II socket
Main motor and inverter	M1 INV1	Flyer driving motor and its inverter • Motor rating : 380 V, 50 Hz, 4P, 15 kW • Inverter rating : 380 V, 15 kW, Vector control with sensor
Winding motor and servo amplifier	M2 AMP2	Servo motor driving the winding mechanism and its servo amplifier • Rating:6 kW, 2000 rpm (Max. 3000 rpm) • With thermostat
Lifting motor and servo amplifier	M3 AMP3	Servo motor driving the lifting mechanism and its servo amplifier • Rating:2.3 kW, 1500 rpm (Max. 2000 rpm) • With thermostat
Drafting motor and servo amplifier	M4 AMP4	Servo motor driving the drafting mechanism and its servo amplifier • Rating:6 kW, 2000 rpm (Max. 3000 rpm) • With thermostat
Tension sensor	PH0	• Detects the roving position for controlling the roving tension.
Absolute encoder	PG0	• Detects the bobbin rail position. (This encoder is used also for error detection of incremental encoder PG3.)
Incremental encoder	PG1	• Detects the rpm of the main motor. (This is used for vector control of inverter INV1.) • Resolution: 2500 PPR • Power source: 5 VDC

[2] Main Control Board

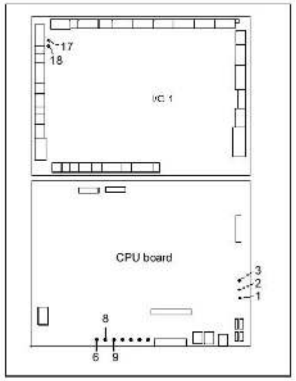
[2.1] Configuration



The main control board consists of three boards-- CPU, I/O1 and I/O2, plus optional board MONITOR.

- CPU board : This board, which holds a microprocessor, executes programs and operation as well as communicating with the function panel.
- I/O1 board : These boards mainly control flyer, winding, drafting, lifting and other roving operations.
- I/O2 board
- MONITOR board (option): This board connects the FL to the network when the FL supports the Toyota Monitoring System TMS.

[2.2] Indicator lamps on the main control board



1 : LD1 (red)
For checking communication with the function panel. OFF if normal.

2 : LD2 (yellow)
For checking communication with the function panel. Blinking if normal.

3 : LD3 (green)
For checking communication with the function panel. Blinking if normal.

6 : LD (red)
For checking control microprocessor operation. Off if normal.

8 : LD8 (yellow)
For checking control microprocessor operation. On if normal.

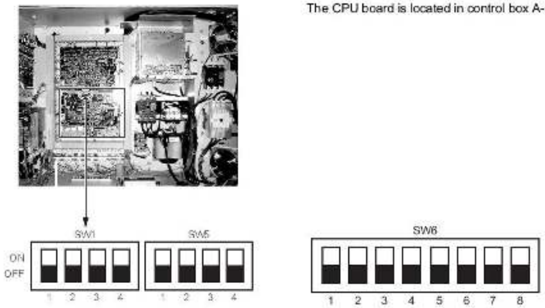
9 : LD9 (yellow)
For checking control microprocessor operation. On if normal.

17 : LED17 (green)
For checking lifting encoder (PG3) operation. ON during bobbin rail up/down motion if normal. (Actually these LEDs are blinking but they look ON because of blinking at very short intervals.)

18 : LED18 (green)
For checking lifting encoder (PG3) operation. ON during bobbin rail up/down motion if normal. (Actually these LEDs are blinking but they look ON because of blinking at very short intervals.)

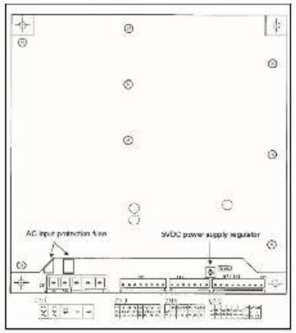
[2.3] DIP switches on the CPU board

The CPU board is located in control box A-BOX.



DIP switch	Bit number	Function	OFF	ON
SW1	Bit 1	Boot ROM write protection	Yes (Write disabled)	No (Write enabled)
	Bit 2	Main control ROM write protection	Yes (Write disabled)	No (Write enabled)
	Bit 3	Starting program	Start by main control ROM	Start by boot ROM
	Bit 4	(Not used)	(Usually)	—
SW5	Bit 1	Internal information initialization	(Usually)	Only at the time of replacement with a new board
	Bit 2	Startup screen selection	Top screen	FL customizing screen
	Bit 3	(Not used)	(Usually)	
	Bit 4	RAM clear protection	Yes (Manual RAM clear disabled)	No (Manual RAM clear enabled)
SW6	Bit 1-8	(Not used)	(Usually)	—

NOTE: All bits should be set to OFF during ordinary operation.



[3]   Control Power Board

This board supplies DC power to the main control board.

■ Power supply specifications

Power input	Terminal No.	Voltage
AC input	AC1, AC2	AC380V to AC460V
DC input	P, N	DC300V to DC800V

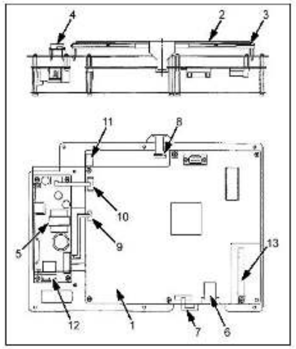
Power output	Terminal No.	Voltage	Max. current	Applications
5 VDC	P5, E5	5 VDC	6 A	For CPU and logic circuits
12 VDC	P12, E12	12 VDC	2.5 A	For input interface
24 VDC	P24, E24	24 VDC	7 A	For output interface
15 VDC	P15, N15, E15	±15 VDC	0.2 A	For analog circuits

- This power supply is equipped with two inputs of AC and DC. In the event of a power failure, regenerative electric power from DC input is received to stop the machine safely. (For operations at the time of power failure, refer to Section 7.1.4, [4].)

⚠ WARNING

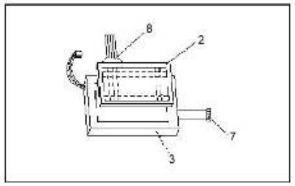
When you need to touch the power supply board, observe the instructions given in Section S.1 "Safe Work" and Section S.1.4 "Rules for Handling and Inspecting Electrical Units".
Also, never touch this power supply board even after turning the power off because a risk of electric shock is present while the capacitor of the main circuit is charged.

[4] Function Panel

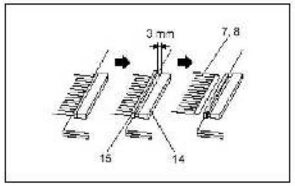


The function panel, which consists of a 10.5-inch TFT color LCD and a touch panel, displays the FL control status and monitored state and allows the user to enter settings.

1 : Panel control board
2 : Touch panel
3 : LCD
4 : Inverter for LCD
5 : Power supply
6 : Ethernet connector
(For communication with the main control board)
7 : LCD harness
8 : Touch sheet harness
9 : Inverter harness
10 : Power harness
11 : Membrane switch harness
12 : 100 VAC input connector
13 : Memory card board harness connector



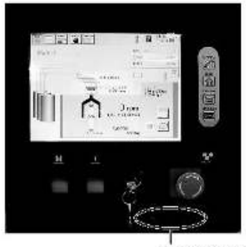
The LCD and touch panel are located on the rear side of the control board with a sheet metal inbetween. Removing the function panel as a unit causes them to appear.



NOTE: Before disconnecting the LCD harness 7 or touch sheet harness 8, be sure to unlock socket 14 by pulling out both ends of lock 15 at the outer end of socket 14 straight by 3 mm.
After inserting each harness into socket 14, push in lock 15.

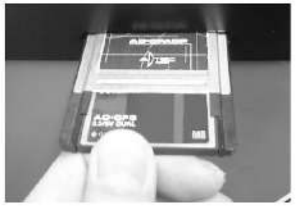
[5] Memory Card

[5.1] Outline



The FL has a memory card interface as standard. Using a memory card can store and load the setting data.

The memory card stores data in the Microsoft Windows file format, so it is possible to open and refer to those data files as a text file from the PC card slot on the computer.



Insert the memory card into the slot as shown at left, and push it until it clicks in position.

AD-CFG
3.3/5V DUAL
COMPACTFLASH CARD
ADAPTER
AD-CFADP
Memory card
Card adapter

■ **Specifications of memory card that comes with the FL**

Card product model	AD-CFG
Interface standard	IDE/ATA interface
Memory capacity	64 MB
Memory card type	CompaceFlash Type-I
Card adapter model	AD-CFADP

NOTE: The card specifications are compliant with the general CompactFlash Type-I; however, using a commercially available CompactFlash card does not guarantee the FL operation. Using the memory card that comes with the FL is recommended.

[5.2] Master program card for main control

A new CPU board comes with no main control program pre-installed, so installation of the main control program is essential for FL operations whenever the CPU board is replaced.

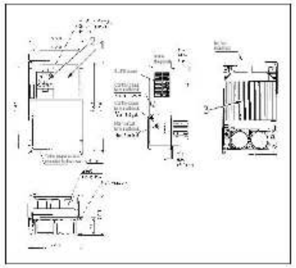
The main control program is provided in the master memory card.

■ File stored in the master program card

F9961-xxxxx-yy (Main control program)
xxxxx : FL specification code
-yy : Program version
(e.g., -00, -0A and -0B)

IMPORTANT

Store this master program card in a safe place. If the main control program with the FL specification code mismatched is installed, the FL does not run correctly.



[6] Main Inverter

[6.1] Outline

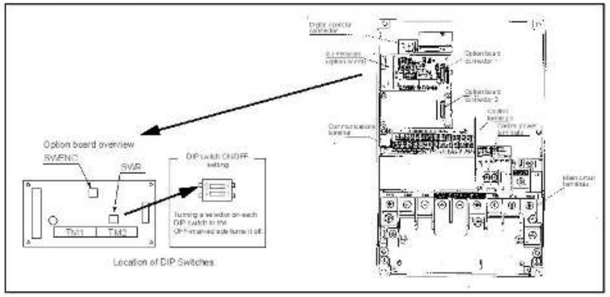
The main inverter controls the speed of main motor M1.

1 : Inverter unit
2 : Digital operator
3 : Radiation fin

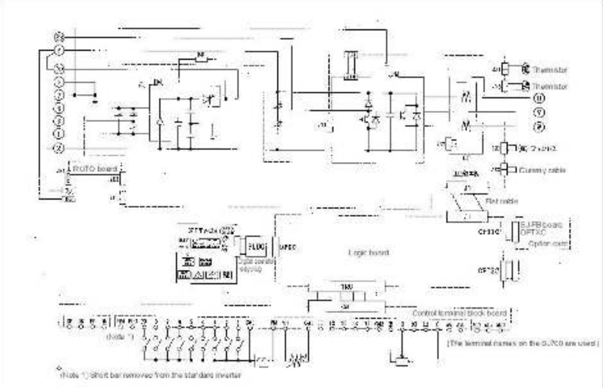
[6.2] Specifications

Inverter type SJ700-150HFFL		Specifications
Maximum applicable motor capacity		15 kW
Output ratings	Output capacity	22 kVA
	Rated output current	32 A
	Maximum output voltage	3-phase, 380/400/415/440/460/480 V (corresponding to input voltage)
	Maximum output frequency	150 Hz in CT mode (for a constant torque load, with low carrier frequency) 400 Hz in VT mode (for a variable torque load, with high carrier frequency)
Power supply	Rated voltage, rated frequency	3-phase, 380/400/415/440/460/480 V, 50/60 Hz
	Allowable voltage fluctuation	-10% to +10%
	Allowable frequency fluctuation	±5%
Control characteristics	Control system	Sinusoidal PWM system (V/f control without PG, Vector control with PG, Vector control without PG)
	Frequency control range	0.1 to 400 Hz
	Frequency accuracy (temperature fluctuation)	Digital command: ±0.01% (-10°C to +40°C) Analog command: ±0.2% (25°C ±10°C)
	Frequency resolution	Digital command: 0.01 Hz Analog command: Maximum frequency/4000 Hz
	Acceleration/deceleration time	0.01 to 3600 sec.
	Overload capability and maximum current	150% of the rated current for one minute 200% of the rated current for 3 seconds

[6.3] Inside of the Inverter

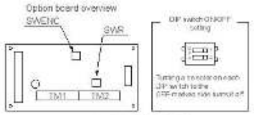

Digital operator connector
Option board connector 1
Option board connector 2
Communications terminal
Main circuit terminals
Option board overview
SWENC
SWR
TM1
TM2
DIP switch ON/OFF setting
Turning a selector on each DIP switch to the OFF-marked side turns it off.
Location of DIP Switches

[6.4] Inverter circuit diagram


Thermistor
Thermistor
U
V
W
ROTO board
Currency cable
Flat cable
OPTXC
Option card
PLDC
Logic board
Digital operator
OPTSC
Control terminal block board
(Note 1)
(The terminal names on the DJ700 are used.)
(Note 1) Short bar removed from the standard inverter

[6.5] Inverter DIP switch settings

On the option board in the inverter are DIP switches SWENC and SWR whose setting items are listed below.
(These DIP switches are configured at the shipment of the FL, so no user setting is required.)


Option board overview
SWENC
SWR
TM1
TM2
DIP switch ON/OFF setting
Turning a selector on each DIP switch to the OFF-marked side turns it off

Location of DIP Switches

DIP switch	Selector No	Setting item		Setting for FL
SWENC	1	ON	Enable wire break detection for no connection of encoder A and B phases.	OFF
		OFF	Disable wire break detection for no connection of encoder A and B phases.	
	2	ON	Enable wire break detection for no connection of encoder Z phase.	OFF
		OFF	Disable wire break detection for no connection of encoder Z phase.	
SWR	1	ON	Terminating resistor (150 Ω) inserted between SAP-SAN	ON
		OFF	No terminating resistor inserted between SAP-SAN	
	2	ON	Terminating resistor (150 Ω) inserted between SBP-SBN	ON
		OFF	No terminating resistor inserted between SBP-SBN	

[6.6] Main inverter INV1 parameter values

Code		Function name	Setting value	Requisite
F mode	F001	Output frequency setting (Hz)	–	Not used.
	F201	Acceleration time setting (s)	2	☆☆
	F202	Acceleration time setting, 2nd motor (s)	30	Not used.
	F302	Acceleration time setting, 3rd motor (s)	30	Not used.
	F003	Deceleration time setting (s)	0.01	☆☆
	F203	Deceleration time setting, 2nd motor (s)	30	Not used.
	F303	Deceleration time setting, 3rd motor (s)	30	Not used.
	F004	Keypad Run key routing	00	Not used.
Basic settings	A001	Frequency source setting	04	☆☆
	A002	Run command source setting	01	☆☆
	A003	Base frequency setting (Hz)	50	☆☆
	A203	Base frequency setting, 2nd motor (Hz)	60	Not used.
	A303	Base frequency setting, 3rd motor (Hz)	60	Not used.
	A004	Maximum frequency setting (Hz)	80	☆☆
	A204	Maximum frequency setting, 2nd motor (Hz)	60	Not used.
	A304	Maximum frequency setting, 3rd motor (Hz)	60	Not used.
Analog input settings	A005	[AT] selection	00	Not used.
	A006	Terminal [O2] function	00	Not used.
	A011	[O]-[L] input active range start frequency (Hz)	0	Not used.
	A012	[O]-[L] input active range end frequency (Hz)	80	Not used.
	A013	[O]-[L] input active range start voltage (%)	0	Not used.
	A014	[O]-[L] input active range end voltage (%)	100	Not used.
	A015	[O]-[L] input active range start frequency selection	01	Not used.
	A016	External frequency filter time constant	8	Not used.
	A017	Easy sequence function selection	00	Not used.
Multispeed and jogging	A019	Multispeed operation selection	00	Not used.
	A020	Multispeed frequency setting (Hz)	0	Not used.
	A220	Multispeed frequency setting, 2nd motor (Hz)	0	Not used.
	A320	Multispeed frequency setting, 3rd motor (Hz)	0	Not used.
	A021	Multispeed 1 setting	0	Not used.
	A022	Multispeed 2 setting	0	Not used.
	A023	Multispeed 3 setting	0	Not used.
	A024	Multispeed 4 setting	0	Not used.
	A025	Multispeed 5 setting	0	Not used.
	A026	Multispeed 6 setting	0	Not used.
	A027	Multispeed 7 setting	0	Not used.
	A028	Multispeed 8 setting	0	Not used.
	A029	Multispeed 9 setting	0	Not used.
	A030	Multispeed 10 setting	0	Not used.
	A031	Multispeed 11 setting	0	Not used.

Code		Function name	Setting value	Requisite
Multispeed and jogging	A032	Multispeed 12 setting	0	Not used.
	A033	Multispeed 13 setting	0	Not used.
	A034	Multispeed 14 setting	0	Not used.
	A035	Multispeed 15 setting	0	Not used.
	A038	Jogging frequency setting (Hz)	1.00	Not used.
	A039	Jog stop mode	00	Not used.
V/f characteristics	A041	Torque boost method selection	00	Not used.
	A241	Torque boost method selection, 2nd motor	00	Not used.
	A042	Manual torque boost value (%)	4.8	Not used.
	A242	Manual torque boost value, 2nd motor (%)	1	Not used.
	A342	Manual torque boost value, 3rd motor (%)	1	Not used.
	A043	Manual torque boost frequency adjustment (%)	10.0	Not used.
	A243	Manual torque boost frequency adjustment, 2nd motor (%)	5	Not used.
	A343	Manual torque boost frequency adjustment, 3rd motor (%)	5	Not used.
	A044	V/f characteristic curve selection, 1st motor	05	☆☆
	A244	V/f characteristic curve selection, 2nd motor	00	Not used.
	A344	V/f characteristic curve selection, 3rd motor	00	Not used.
	A045	V/f gain setting (%)	100	☆☆
	A046	Voltage compensation gain for automatic torque boost, 1st motor	100	Not used.
	A246	Voltage compensation gain for automatic torque boost, 2nd motor	100	Not used.
	A047	Slip compensation gain for automatic torque boost, 1st motor	100	Not used.
	A247	Slip compensation gain for automatic torque boost, 2nd motor	100	Not used.
DC braking	A051	DC braking enable	00	☆
	A052	DC braking frequency (Hz)	0.3	Not used.
	A053	DC braking wait time (s)	0	Not used.
	A054	DC braking force during deceleration (%)	28	Not used.
	A055	DC braking time for deceleration (s)	0.5	Not used.
	A056	DC braking/edge or level detection for [DB] input	01	Not used.
	A057	DC braking force for starting (%)	0	Not used.
	A058	DC braking time for starting (s)	0	Not used.
	A059	DC braking carrier frequency (Hz)	5	Not used.
Frequency limits and jump frequency	A061	Frequency upper limit setting (Hz)	80	☆
	A261	Frequency upper limit setting, 2nd motor (Hz)	0	Not used.
	A062	Frequency lower limit setting (Hz)	0	☆
	A262	Frequency lower limit setting, 2nd motor (Hz)	0	Not used.
	A063	Jump (center) frequency setting 1 (Hz)	0	Not used.
	A064	Jump (hysteresis) frequency width setting 1 (Hz)	0.5	Not used.
	A065	Jump (center) frequency setting 2 (Hz)	0	Not used.
	A066	Jump (hysteresis) frequency width setting 2 (Hz)	0.5	Not used.
	A067	Jump (center) frequency setting 3 (Hz)	0	Not used.
	A068	Jump (hysteresis) frequency width setting 3 (Hz)	0.5	Not used.
	A069	Acceleration stop frequency setting (Hz)	0	Not used.
	A070	Acceleration stop time setting (s)	0	Not used.

Code		Function name	Setting value	Requisite
PID control	A071	PID enable	00	☆
	A072	PID proportional gain	1	Not used.
	A073	PID integral time constant	1	Not used.
	A074	PID derivative gain	0	Not used.
	A075	PV scale conversion	1	Not used.
	A076	PV source setting	00	Not used.
	A077	Output of inverted PID deviation	00	Not used.
	A078	PID variation range	0.0	Not used.
AVR	A081	AVR function select	00	☆☆
	A082	AVR voltage select	380	☆☆
Operation mode and acceleration/deceleration function	A085	Operation mode selection	00	☆
	A086	Energy saving mode tuning	50	Not used.
	A092	Acceleration (2) time setting (s)	0.1	Not used.
	A292	Acceleration (2) time setting, 2nd motor (s)	15	Not used.
	A392	Acceleration (2) time setting, 3rd motor (s)	15	Not used.
	A093	Deceleration (2) time setting (s)	0.1	Not used.
	A293	Deceleration (2) time setting, 2nd motor (s)	15	Not used.
	A393	Deceleration (2) time setting, 3rd motor (s)	15	Not used.
	A094	Select method to switch to Acc2/Dec2	00	Not used.
	A294	Select method to switch to Acc2/Dec2, 2nd motor	00	Not used.
	A095	Acc1 to Acc2 frequency transition point (Hz)	0	Not used.
	A295	Acc1 to Acc2 frequency transition point, 2nd motor (Hz)	0	Not used.
	A096	Dec1 to Dec2 frequency transition point (Hz)	0	Not used.
	A296	Dec1 to Dec2 frequency transition point, 2nd motor (Hz)	0	Not used.
	A097	Acceleration curve selection	00	☆
	A098	Deceleration curve selection	00	☆
External frequency adjustment	A101	[OI]-[L] input active range start frequency (Hz)	0	Not used.
	A102	[OI]-[L] input active range end frequency (Hz)	0	Not used.
	A103	[OI]-[L] input active range start current (%)	20	Not used.
	A104	[OI]-[L] input active range end current (%)	100	Not used.
	A105	[OI]-[L] input start frequency enable	00	Not used.
	A111	[O2]-[L] input active range start frequency (Hz)	0	Not used.
	A112	[O2]-[L] input active range end frequency (Hz)	0	Not used.
	A113	[O2]-[L] input active range start voltage (%)	-100	Not used.
	A114	[O2]-[L] input active range end voltage (%)	100	Not used.
Acceleration and deceleration	A131	Acceleration curve constants setting	02	Not used.
	A132	Deceleration curve constants setting	02	Not used.
Operation-target frequency	A141	Operation-target frequency selection 1	02	Not used.
	A142	Operation-target frequency selection 2	03	Not used.
	A143	Operator selection	00	Not used.
	A145	Frequency to be added	0.00	Not used.
	A146	Sign of the frequency to be added	00	Not used.

Code		Function name	Setting value	Requisite
Acceleration and deceleration	A150	EL-S-curve acceleration ratio 1	25	Not used.
	A151	EL-S-curve acceleration ratio 2	25	Not used.
	A152	EL-S-curve deceleration ratio 1	25	Not used.
	A153	EL-S-curve deceleration ratio 2	25	Not used.
Restart after instantaneous power failure or tripping	B001	Selection of restart mode	00	☆
	B002	Allowable under-voltage power failure time (s)	1	☆
	B003	Retry wait time before motor restart (s)	1	Not used.
	B004	Instantaneous power failure/under-voltage trip alarm enable	00	☆
	B005	Number of restarts on power failure/under-voltage trip events	00	Not used.
	B006	Phase loss detection enable	00	☆
	B007	Restart frequency threshold (Hz)	0	Not used.
	B008	Selection of retry after tripping	00	☆
	B009	Selection of retry after undervoltage	00	Not used.
	B010	Selection of retry count after overvoltage or overcurrent	3	Not used.
	B011	Retry wait time after tripping	1.0	Not used.
Electronic thermal function	B012	Electronic thermal setting (calculated within the inverter from current output)	29.0	☆☆
	B212	Electronic thermal setting (calculated within the inverter from current output), 2nd motor	32	Not used.
	B312	Electronic thermal setting (calculated within the inverter from current output), 3rd motor	32	Not used.
	B013	Electronic thermal characteristic	01	☆☆
	B213	Electronic thermal characteristic, 2nd motor	00	Not used.
	B313	Electronic thermal characteristic, 3rd motor	00	Not used.
	B015	Free setting, electronic thermal frequency (1)	0	Not used.
	B016	Free setting, electronic thermal current (1)	0	Not used.
	B017	Free setting, electronic thermal frequency (2)	0	Not used.
	B018	Free setting, electronic thermal current (2)	0	Not used.
	B019	Free setting, electronic thermal frequency (3)	0	Not used.
	B020	Free setting, electronic thermal current (3)	0	Not used.
Overload restriction and overcurrent restraint	B021	Overload restriction operation mode	00	☆
	B022	Overload restriction setting	48	Not used.
	B023	Deceleration rate at overload restriction	1	Not used.
	B024	Overload restriction operation mode (2)	01	Not used.
	B025	Overload restriction setting (2)	48	Not used.
	B026	Deceleration rate at overload restriction (2)	1	Not used.
	B027	Overcurrent suppression enable	00	☆
	B028	Active frequency matching, scan start frequency	32.0	Not used.
	B029	Active frequency matching, scan-time constant	0.50	Not used.
	B030	Active frequency matching, restart frequency select	00	Not used.
Software lock	B031	Software lock mode selection	01	☆

Code		Function name	Setting value	Requisite
Others	B034	Run/power-on warning time	0	Not used.
	B035	Rotational direction restriction	00	☆
	B036	Reduced voltage start selection	00	Not used.
	B037	Function code display restriction	00	☆
	B038	Initial-screen selection	01	☆
	B039	Automatic user-parameter setting function enable	00	Not used.
Torque limitation	B040	Torque limit selection	00	☆☆
	B041	Torque limit (1) (forward-driving in 4-quadrant mode)	200	☆☆
	B042	Torque limit (2) (reverse-regenerating in 4-quadrant mode)	200	☆☆
	B043	Torque limit (3) (reverse-driving in 4-quadrant mode)	200	☆☆
	B044	Torque limit (4) (forward-regenerating in 4-quadrant mode)	200	☆☆
	B045	Torque limit LADSTOP enable	00	☆
Others	B046	Reverse run protection enable	00	☆
	B050	Controller deceleration and stop on power loss	01	☆☆
	B078	Cumulative input power data clearance	00	Not used.
	B079	Cumulative input power display gain setting	1	Not used.
	B082	Start frequency adjustment (Hz)	0.3	Not used.
	B083	Carrier frequency setting (kHz)	5.0	☆☆
	B084	Initialization mode (parameters or trip history)	00	Not used.
	B085	Country code for initialization	00	Not used.
	B086	Frequency scaling conversion factor	1	Not used.
	B087	STOP key enable	02	☆
	B088	Restart mode after FRS	00	Not used.
	B090	Dynamic braking usage ratio (%)	10	☆☆
	B091	Stop mode selection	00	☆☆
	B092	Cooling fan control	00	Not used.
	B095	Dynamic braking control	01	☆☆
	B096	Dynamic braking activation level	720	☆☆
	B098	Thermistor for thermal protection control	00	Not used.
	B099	Thermal protection level setting	3000	Not used.
Free setting of V/f characteristic	B100	Free-setting V/f frequency 1(Hz)	0	Not used.
	B101	Free-setting V/f voltage 1(V)	0	Not used.
	B102	Free-setting V/f frequency 2(Hz)	0	Not used.
	B103	Free-setting V/f voltage 2(V)	0	Not used.
	B104	Free-setting V/f frequency 3(Hz)	0	Not used.
	B105	Free-setting V/f voltage 3(V)	0	Not used.
	B106	Free-setting V/f frequency 4(Hz)	0	Not used.
	B107	Free-setting V/f voltage 4(V)	0	Not used.
	B108	Free-setting V/f frequency 5(Hz)	0	Not used.
	B109	Free-setting V/f voltage 5(V)	0	Not used.
	B110	Free-setting V/f frequency 6(Hz)	0	Not used.
	B111	Free-setting V/f voltage 6(V)	0	Not used.
	B112	Free-setting V/f frequency 7(Hz)	0	Not used.
	B113	Free-setting V/f voltage 7(V)	0	Not used.

Code		Function name	Setting value	Requisite
Others	B120	Brake control enable	00	Not used.
	B121	Brake wait time for release	0	Not used.
	B122	Brake wait time for acceleration	0	Not used.
	B123	Brake wait time for stopping	0	Not used.
	B124	Brake wait time for confirmation	0	Not used.
	B125	Brake release frequency setting (Hz)	0	Not used.
	B126	Brake release current setting	32.0	Not used.
	B127	Braking frequency	0.00	Not used.
	B130	Overvoltage suppression enable	00	☆
	B131	Overvoltage suppression level	760	Not used.
	B132	Acceleration and deceleration rate at overvoltage suppression	1.00	Not used.
Intelligent input terminals	C001	Terminal [1] function	18	Not used.
	C002	Terminal [2] function	16	Not used.
	C003	Terminal [3] function	48	☆☆
	C004	Terminal [4] function	47	☆☆
	C005	Terminal [5] function	09	Not used.
	C006	Terminal [6] function	26	☆☆
	C007	Terminal [7] function	07	Not used.
	C008	Terminal [8] function	01	Not used.
	C011	Terminal [1] active state	00	Not used.
	C012	Terminal [2] active state	00	Not used.
	C013	Terminal [3] active state	01	☆☆
	C014	Terminal [4] active state	01	☆☆
	C015	Terminal [5] active state	00	Not used.
	C016	Terminal [6] active state	00	☆☆
	C017	Terminal [7] active state	00	Not used.
	C018	Terminal [8] active state	00	Not used.
	C019	Terminal [FW] active state	00	☆
Intelligent output terminals	C021	Terminal [11] function	05	☆☆
	C022	Terminal [12] function	50	☆☆
	C023	Terminal [13] function	44(MO1)	☆☆
	C024	Terminal [14] function	00	Not used.
	C025	Terminal [15] function	08	Not used.
	C026	Alarm relay terminal function	05	Not used.
Analog monitoring	C027	[FM] signal selection	00	Not used.
	C028	[AM] signal selection	20	☆☆
	C029	[AMI] signal selection	00	Not used.
	C030	Digital current monitor reference value	32.0	Not used.

Code		Function name	Setting value	Requisite
Intelligent output terminals	C031	Terminal [11] active state	01	☆☆
	C032	Terminal [12] active state	00	☆☆
	C033	Terminal [13] active state	01	☆☆
	C034	Terminal [14] active state	00	Not used.
	C035	Terminal [15] active state	00	Not used.
	C036	Alarm relay active state	01	Not used.
	C038	Low-current indication signal output mode selection	01	Not used.
	C039	Low-current indication signal detection level	32.0	Not used.
	C040	Overload signal output mode	01	Not used.
	C041	Overload level setting (%)	32.0	Not used.
	C042	Frequency arrival setting for accel. (Hz)	0	Not used.
	C043	Frequency arrival setting for decel. (Hz)	0	Not used.
	C044	PID deviation level setting	3	Not used.
	C045	Frequency arrival setting for acceleration (2) (Hz)	0	Not used.
	C046	Frequency arrival setting for deceleration (2) (Hz)	0	Not used.
	C052	Maximum PID feedback data	100.0	Not used.
	C053	Minimum PID feedback data	0.0	Not used.
	C055	Over-torque (forward-driving) level setting (%)	100	Not used.
	C056	Over-torque (reverse regenerating) level setting (%)	100	Not used.
	C057	Over-torque (reverse driving) level setting (%)	100	Not used.
	C058	Over-torque (forward regenerating) level setting (%)	100	Not used.
	C061	Electronic thermal warning level setting (%)	80	Not used.
	C062	Alarm code output	00	☆
	C063	Zero speed detection level (Hz)	0	Not used.
	C064	Heat sink overheat warning level	120.0	Not used.
Communication function	C071	Communication speed selection	06	☆☆
	C072	Node allocation	1	☆☆
	C073	Communication data length selection	8	☆☆
	C074	Communication parity selection	01	☆☆
	C075	Communication stop bit selection	1	☆☆
	C076	Selection of the operation after communication error	02	☆☆
	C077	Communication timeout limit before tripping	0.00	☆☆
	C078	Communication wait time	0	☆☆
	C079	Communication mode selection	00	☆☆
Adjustment	C081~083	[O] input span calibration [OI] input span calibration [O2] input span calibration		Not used.
	C085	Thermistor input tuning		Not used.
Others	C091	Debug mode enable	00	Not used.
	C101	Up/Down memory mode selection	00	Not used.
	C102	Reset mode selection	00	Not used.
	C103	Restart mode after reset	00	Not used.

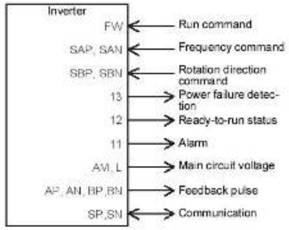
Code		Function name	Setting value	Requisite
Meter adjustment	C105	FM gain adjustment	100	Not used.
	C106	AM gain adjustment	íðèÆil	Not used.
	C107	AMI gain adjustment	100	Not used.
	C109	AM bias adjustment	íðèÆil	Not used.
	C110	AMI bias adjustment	20	Not used.
Others	C111	Overload setting 2(%)	32.0	Not used.
	C121 to 123	[O] input zero calibration	XXXXXXXXXXXX	Not used.
Output terminal operation function	C130	Output 11 on-delay time	0	Not used.
	C131	Output 11 off-delay time	0	Not used.
	C132	Output 12 on-delay time	0	Not used.
	C133	Output 12 off-delay time	0	Not used.
	C134	Output 13 on-delay time	0	Not used.
	C135	Output 13 off-delay time	0	Not used.
	C136	Output 14 on-delay time	0	Not used.
	C137	Output 14 off-delay time	0	Not used.
	C138	Output 15 on-delay time	0	Not used.
	C139	Output 15 off-delay time	0	Not used.
	C140	Output RY on-delay time	0	Not used.
	C141	Output RY off-delay time	0	Not used.
	C142	Logical output signal 1 selection 1	0	Not used.
	C143	Logical output signal 1 selection 2	0	Not used.
	C144	Logical output signal 1 operator selection	0	Not used.
	C145	Logical output signal 2 selection 1	0	Not used.
	C146	Logical output signal 2 selection 2	0	Not used.
	C147	Logical output signal 2 operator selection	0	Not used.
	C148	Logical output signal 3 selection 1	0	Not used.
	C149	Logical output signal 3 selection 2	0	Not used.
	C150	Logical output signal 3 operator selection	0	Not used.
	C151	Logical output signal 4 selection 1	0	Not used.
	C152	Logical output signal 4 selection 2	0	Not used.
	C153	Logical output signal 4 operator selection	0	Not used.
	C154	Logical output signal 5 selection 1	0	Not used.
	C155	Logical output signal 5 selection 2	0	Not used.
	C156	Logical output signal 5 operator selection	0	Not used.
	C157	Logical output signal 6 selection 1	0	Not used.
	C158	Logical output signal 6 selection 2	0	Not used.
	C159	Logical output signal 6 operator selection	0	Not used.

Code		Function name	Setting value	Requisite
Control constants	H001	Auto-tuning Setting	00	☆
	H002	Motor data selection, 1st motor	00	☆☆
	H202	Motor data selection, 2nd motor	00	Not used.
	H003	Motor capacity. 1st motor	15kW	☆☆
	H203	Motor capacity, 2nd motor	15kW	Not used.
	H004	Motor poles setting, 1st motor	4	☆☆
	H204	Motor poles setting, 2nd motor	4	Not used.
	H005	Motor speed constant, 1st motor	4.59	☆☆
	H205	Motor speed constant, 2nd motor	1.59	Not used.
	H006	Motor stabilization constant, 1st motor	100	Not used.
	H206	Motor stabilization constant, 2nd motor	100	Not used.
	H306	Motor stabilization constant, 3rd motor	100	Not used.
	H020	Motor constant R1, 1st motor	0.32	☆
	H220	Motor constant R1, 2nd motor	0.32	Not used.
	H021	Motor constant R2, 1st motor	0.228	☆
	H221	Motor constant R2, 2nd motor	0.228	Not used.
	H022	Motor constant L, 1st motor	5.16	☆
	H222	Motor constant L, 2nd motor	5.16	Not used.
	H023	Motor constant IO	8.46	☆☆
	H223	Motor constant IO, 2nd motor	12.7	Not used.
	H024	Motor constant J	0.303	☆☆
	H224	Motor constant J, 2nd motor	0.213	Not used.
	H030	Auto constant R1, 1st motor	0.320	Not used.
	H230	Auto constant R1, 2nd motor	0.320	Not used.
	H031	Auto constant R2, 1st motor	0.228	Not used.
	H231	Auto constant R2, 2nd motor	0.228	Not used.
	H032	Auto constant L, 1st motor	5.16	Not used.
	H232	Auto constant L, 2nd motor	5.16	Not used.
	H033	Auto constant IO, 1st motor	12.70	Not used.
	H233	Auto constant IO, 2nd motor	12.70	Not used.
	H034	Auto constant J, 1st motor	0.213	Not used.
	H234	Auto constant J, 2nd motor	0.213	Not used.

Code		Function name	Setting value	Requisite
Control constants	H050	PI proportional gain for 1st motor (%)	200	☆☆
	H250	PI proportional gain for 2nd motor (%)	100	Not used.
	H051	PI integral gain for 1st motor (%)	50	☆☆
	H251	PI integral gain for 2nd motor (%)	100	Not used.
	H052	P proportional gain setting for 1st motor	1	Not used.
	H252	P proportional gain setting for 2nd motor	1	Not used.
	H060	Zero LV limiter for 1st motor (%)	100	Not used.
	H260	Zero LV limiter for 2nd motor (%)	100	Not used.
	H061	Zero LV starting boost current for 1st motor	50	Not used.
	H261	Zero LV starting boost current for 2nd motor	50	Not used.
	H070	Terminal selection PI proportional gain setting (%)	100	Not used.
	H071	Terminal selection PI integral gain setting (%)	100	Not used.
	H072	Terminal selection P proportional gain setting	1	Not used.
	H073	Gain switching time (msec)	100	Not used.
Gain mapping	H100	Gain mapping function selection	01	☆☆
	H101	Gain switching frequency 1 (Hz)	0	☆☆
	H102	Gain switching frequency 2 (Hz)	0.3	☆☆
	H103	Gain switching frequency 3 (Hz)	15	☆☆
	H104	Proportional gain reduction rate 1 (%)	50	☆☆
	H105	Proportional gain reduction rate 2 (%)	60	☆☆
	H106	Proportional gain reduction rate 3 (%)	100	☆☆
	H107	Integral gain reduction rate 1 (%)	50	☆☆
	H108	Integral gain reduction rate 2 (%)	60	☆☆
	H109	Integral gain reduction rate 3 (%)	100	☆☆
Optional functions	P001	Operation mode on expansion card 1 error	01	☆
	P002	Operation mode on expansion card 2 error	00	Not used.
	P011	Encoder pulse-per-revolution (PPR) setting	1250	☆☆
	P012	Control pulse setting	01	☆☆
	P013	Pulse line mode setting	01	☆☆
	P014	Home search stop position setting	0	Not used.
	P015	Home search speed setting (Hz)	5	Not used.
	P016	Home search direction setting	00	Not used.
	P017	Home search completion range setting	5	Not used.
	P018	Home search completion delay time setting	0	Not used.
	P019	Electronic gear set position selection	01	☆☆
	P020	Electronic gear ratio numerator setting	2	☆☆
	P021	Electronic gear ratio denominator setting	1	☆☆
	P022	Feed-forward gain setting	2.2	☆☆
	P023	Position loop gain setting	5.0	☆☆
	P025	Temperature compensation thermistor enable	00	Not used.
	P026	Over-speed error detection level setting (%)	135	☆
	P027	Speed deviation error detection level setting (Hz)	7.5	Not used.
	P028	Numerator of motor gear ratio	1	☆
	P029	Denominator of motor gear ratio	1	☆

Code		Function name	Setting value	Requisite
Optional functions	P031	Accel/decel time input selection	00	Not used.
	P032	Positioning command input selection	00	Not used.
	P033	Torque command input selection	00	Not used.
	P034	Torque command setting	0	Not used.
	P035	Polarity selection at the torque command input via O2 terminal	00	Not used.
	P036	Torque bias mode	00	Not used.
	P037	Torque bias value	0	Not used.
	P038	Torque bias polarity selection	00	Not used.
	P039	Speed limit for torque-controlled operation (forward rotation)	0.00	Not used.
	P040	Speed limit for torque-controlled operation (reverse rotation)	0.00	Not used.
	P044	DeviceNet comm watchdog timer	1	Not used.
	P045	Inverter action on DeviceNet comm error	01	Not used.
	P046	DeviceNet polled I/O: Output instance number	21	Not used.
	P047	DeviceNet polled I/O: Input instance number	71	Not used.
	P048	Inverter action on DeviceNet idle mode	01	Not used.
	P049	DeviceNet motor poles setting for RPM	0	Not used.
	P055	Pulse-string frequency scale	50.0	Not used.
	P056	Time constant of pulse-string frequency filter	0.1	Not used.
	P057	Pulse-string frequency bias	0	Not used.
	P058	Pulse-string frequency limit	100	Not used.
Power failure control	P100	Decelerate-to-stop start voltage for power failure	445	☆☆
	P101	Decelerate-to-stop target voltage for power failure	650	☆☆
	P102	Decelerate-to-stop proportional gain for power failure	1.2	☆☆
	P103	Decelerate-to-stop integral gain for power failure	50.0	☆☆
	P104	Power failure running signal level	0	☆
Easy sequence function	P105	Easy sequence user parameter U (05)	0	Not used.
	P106	Easy sequence user parameter U (06)	0	Not used.
	P107	Easy sequence user parameter U (07)	0	Not used.
	P108	Easy sequence user parameter U (08)	0	Not used.
	P109	Easy sequence user parameter U (09)	0	Not used.
	P110	Easy sequence user parameter U (10)	0	Not used.
	P111	Easy sequence user parameter U (11)	0	Not used.
	P112	Easy sequence user parameter U (12)	0	Not used.
	P113	Easy sequence user parameter U (13)	0	Not used.
	P114	Easy sequence user parameter U (14)	0	Not used.
	P115	Easy sequence user parameter U (15)	0	Not used.
	P116	Easy sequence user parameter U (16)	0	Not used.
	P117	Easy sequence user parameter U (17)	0	Not used.
	P118	Easy sequence user parameter U (18)	0	Not used.
	P119	Easy sequence user parameter U (19)	0	Not used.
	P120	Easy sequence user parameter U (20)	0	Not used.
	P121	Easy sequence user parameter U (21)	0	Not used.
	P122	Easy sequence user parameter U (22)	0	Not used.

Code		Function name	Setting value	Requisite
Easy sequence function	P123	Easy sequence user parameter U (23)	0	Not used.
	P124	Easy sequence user parameter U (24)	0	Not used.
	P125	Easy sequence user parameter U (25)	0	Not used.
	P126	Easy sequence user parameter U (26)	0	Not used.
	P127	Easy sequence user parameter U (27)	0	Not used.
	P128	Easy sequence user parameter U (28)	0	Not used.
	P129	Easy sequence user parameter U (29)	0	Not used.
	P130	Easy sequence user parameter U (30)	0	Not used.
	P131	Easy sequence user parameter U (31)	0	Not used.
User parameters	U001	User-selected function 1	NO	Not used.
	U002	User-selected function 2	NO	Not used.
	U003	User-selected function 3	NO	Not used.
	U004	User-selected function 4	NO	Not used.
	U005	User-selected function 5	NO	Not used.
	U006	User-selected function 6	NO	Not used.
	U007	User-selected function 7	NO	Not used.
	U008	User-selected function 8	NO	Not used.
	U009	User-selected function 9	NO	Not used.
	U010	User-selected function 10	NO	Not used.
	U011	User-selected function 11	NO	Not used.
	U012	User-selected function 12	NO	Not used.


Inverter
FW
SAP, SAN
SBP, SBN
13
12
11
AM, L
AP, AN, BP,BN
SP,SN
Run command
Frequency command
Rotation direction command
Power failure detection
Ready-to-run status
Alarm
Main circuit voltage
Feedback pulse
Communication

[6.7] Control interface

Run command:
Run command to the inverter

Frequency command:
Input of reference frequency in pulse train for generating the inverter output frequency to change the motor speed.

Rotation direction command:
Input for determining the motor rotation direction.

Power failure detection:
Output signal telling that a power failure has occurred.

Ready-to-run status:
Output signal telling that the inverter is ready to run.

Alarm:
Output signal telling that an alarm has occurred in the inverter.

Main circuit voltage:
Output signal for telling the main circuit voltage to be monitored after a power failure has occurred.

Feedback pulse:
Pulse train signal for detecting the actual rpm of the main motor.

Communication:
Data exchange between the inverter and the main control board via the RS-485 interface.

NOTE: For detailed inverter specifications and handling instructions, refer to the inverter instruction manual (prepared by the inverter manufacturer) that comes with the FL.

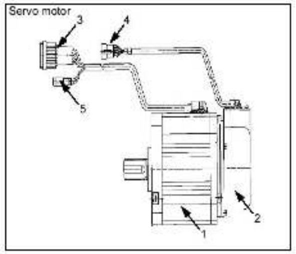
[7] Servo Motors and Amplifiers

[7.1] Servo motors

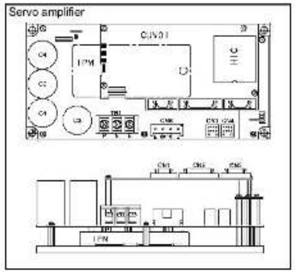
Servo motors drive the winding, lifting, and drafting mechanisms.

■ Specifications of servo motors

Drive target	Motor capacity (kW)	Rated speed (rpm)	Maximum speed (rpm)	Thermostat
Winding mechanism	6	2000	3000	Provided
Lifting mechanism	2.3	1500	2000	Provided
Drafting mechanism	6	2000	3000	Provided


Servo motor

1 : Motor unit
2 : Resolver (rpm detector)
3 : Power cable connector
4 : Resolver cable connector
5 : Thermostat cable connector


Servo amplifier

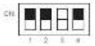
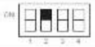
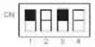
[7.2] Servo amplifiers

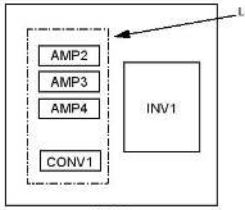
(1) Specifications

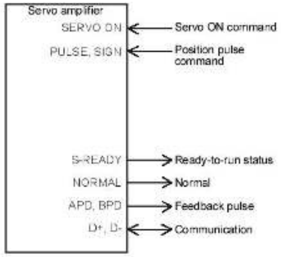
Model		VLASV-050T6	
Control system		3-phase sinusoidal PWM system	
Main circuit power voltage		530 to 650 VDC	
Control power voltage		24 VDC ± 10%	
Applicable motor manufactured by Tamagawa Seiki		• Rated output: 6.0 kW • Rated speed: 2000 min^{-1} (max: 3000 min^{-1}) • Rated current: 18.1 A (rms) (Instantaneous maximum: 44.8 A (rms)) • Torque constant: 1.61 (N•m/A)	• Rated output: 2.3 kW • Rated speed: 1500 min^{-1} (max: 2000 min^{-1}) • Rated current: 8.74 A (rms) (Instantaneous maximum: 25.6 A (rms)) • Torque constant: 1.78 (N•m/A)
Continuous current rating		19.8 A (rms)	
Instantaneous maximum current (instantaneous maximum torque)		41.6 A (rms) (67.08 N•m)	
Speed position detector		Resolver (20 kHz, 2-phase excitation, single-phase output)	
Heat loss	Main circuit	144 W	
	Control circuit	20 W	
Countercurrent absorption capacity		None	
Mass		1.7 kg	
Outside dimensions (mm) (H x W x D)		120 × 250 × 96	
Amplifier structure		Open frame	
Interface		RS-485 interface	
General-purpose input		24 VDC, 6 mA, 8 ports Both sink (negative common) and source (positive common) connections are possible.	
General-purpose output		12 VDC, 10 mA, 5 ports Both sink (negative common) and source (positive common) connections are possible.	
General-purpose input/ output power supply		24 VDC and 12 VDC supplied externally	
Position control	Number of divisions	Resolver: 24,000 P/rev (Distance per pulse can be set by 65,535/65,535.)	
	Command pattern	Forward/reverse rotation pulse (A-/B-phase pulse and forward/reverse signal/feed pulse are available.). Input voltage 2.3 to 3.5 VDC (TA = 25°C), Frequency 500 kHz (max.)	

(2) Setting up servo amplifiers

NOTE: Each servo amplifier should be set up with its DIP switch SW1. As shown below, the switch configuration differs with the target motor.

Servo amplifier symbol	Motor	Configuration of DIP Switch SW1
AMP2	Winding motor	
AMP3	Lifting motor	
AMP4	Drafting motor	


Location of servo amplifiers
AMP2
AMP3
AMP4
INV1
CONV1
B-BOX


Servo amplifier
SERVO ON
PULSE, SIGN
S-READY
NORMAL
APD, BPD
D+, D-
Servo ON command
Position pulse command
Ready-to-run status
Normal
Feedback pulse
Communication

(3) Control interface

Servo ON command:

Input for running the servo motor.

Position pulse command:

Input of motor rotation amount in pulse train.

Ready-to-run status:

Output signal telling that the servo motor is ready to run.

Normal:

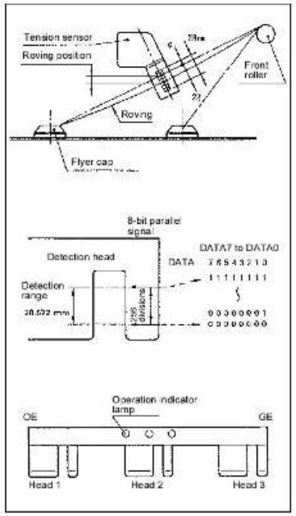
Output signal telling that the servo amplifier is normal. OFF for abnormal stop.

Feedback pulse:

Feedback pulse signal of servo motor rotation.

Communication:

Data exchange between the servo amplifier and the main control board via the RS-485 interface.


Tension sensor
Roving positon
28m
6
22
Front roller
Roving
Flyer cap
8-bit parallel signal
Detection head
DATA7 to DATA0
DATA 7 6 5 4 3 2 1 0
1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0
Detection range
28.572 mm
256 divisions
Operation indicator lamp
OE
GE
Head 1
Head 2
Head 3

[8] Tension Sensor

The tension sensor detects the roving position between the front roller and the flyer cap for control of the roving tension.

(1) Specifications

1) Detector section: 3 heads, 28 mm
(effective detection range)

2) Minimum detectable size of target and detection accuracy:
0.5 mm dia., ± 0.224 mm

3) Detection time: 6 msec (for 3 heads)

4) Power supply: 12 VDC ± 5%
(switching regulator power supply)

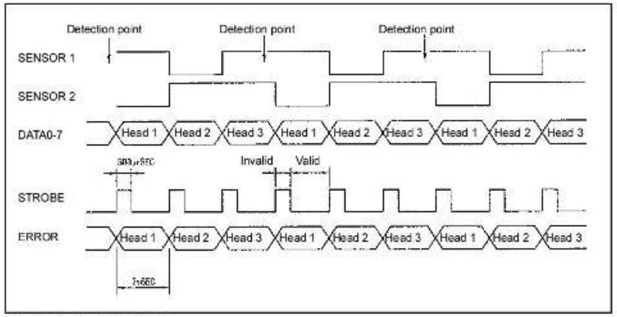
5) Power consumption: 700 mA or below

(2) Control output

1) Roving position signal
(8-bit parallel signal)
Sensor head selection signal (SENSOR 1, 2)

	SENSOR 1	SENSOR 2
Head 1	1	0
Head 2	0	1
Head 3	1	1

1: Output transistor OFF (High)
0: Output transistor ON (Low)


Detection point
Detection point
Detection point
SENSOR 1
SENSOR 2
DATA0-7
Head 1
Head 2
Head 3
Head 1
Head 2
Head 3
Head 1
Head 2
Head 3
500 μSEC
Invalid
Valid
STROBE
ERROR
Head 1
Head 2
Head 3
Head 1
Head 2
Head 3
Head 1
Head 2
Head 3
3 mSEC

2) Strobe signal (STROBE)

- The STROBE signal informs the FL microprocessor of the validity of DATA7-0.
- At the falling edge of the STROBE signal, the microprocessor reads in roving position signal DATA7-0.

3) Sensor error signals (ERROR)

In any of the following cases, the tension sensor informs the microprocessor of the abnormality of sensor heads using the ERROR signal in synchronization with the sensor head selection signals SENSOR1 and SENSOR2.

a. When the detection ranges of all heads are shielded.

b. When no roving is present in the detection ranges of all heads.

c. When two or more rovings are detected.

Normal	1 (Output transistor OFF)
Abnormal	0 (Output transistor ON)

(3) FL operation

1) Sampling

The FL microprocessor reads in roving position signal DATA7-0 at each falling edge of the STROBE signal.

2) Roving tension control

The FL microprocessor compares the current roving position data (obtained by the tension sensor) and the preset target one at any time during roving operation including acceleration from start, deceleration to stop, and inching to control the roving tension.

(4) Sensor cable and signal assignment

		Interface with the main control board	
Signal name	Wire color	Pin No. (on connector CN58)	Terminal board TB120 Mark tube name
+12V	Black/yellow	—	P12
GND	Red/yellow	B10	
SENSOR1	Green/yellow	A9	
SENSOR2	White	A10	
ERROR	Gray	—	151
STROBE	Purple	—	150
DATA0	Blue	A1	
DATA1	Green	A2	
DATA2	Blue/yellow	A3	
DATA3	Yellow	A4	
DATA4	White/yellow	A5	
DATA5	Orange	A6	
DATA6	Red	A7	
DATA7	Brown	A8	

7.1.3 Descriptions of Individual Operation and Function

[1] Prevention of Thin Roving Irregularity

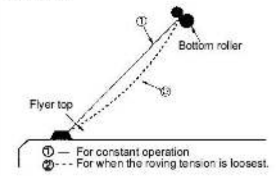
When the machine is restarted with the roving stretched over the front roller and the flyer cap, the start will be completed with the roving in constant tension provided mechanical synchronization is perfect.

If the synchronization is even slightly imperfect, the roving tension becomes too high. Subsequently, abnormal tension is applied, causing thin roving irregularity.

To prevent the thin roving irregularity from being generated, when the FL stops or decelerates, the tension of roving between the front roller and the flyer cap is made slightly loose beforehand.

The FL has two types of the prevention function of thin roving irregularity--"Prevention of thin roving irregularity for the time of operation stop" and "Prevention of thin roving irregularity for the deceleration time." The former feeds extra roving immediately before the FL stops; the latter decreases the winding amount during deceleration.

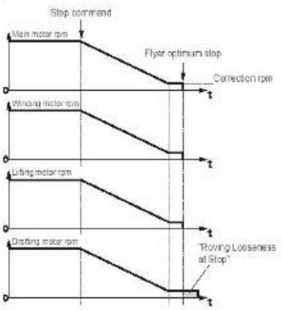
State diagram of roving between the front roller and flyer top

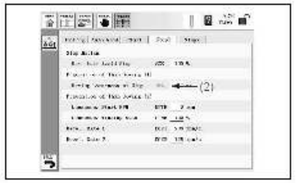

①
Bottom roller
②
Flyer top
① — For constant operation
② - - - For when the roving tension is loosest.

[1-1] Prevention of thin roving irregularity for the time of operation stop

(1) Operation sequence

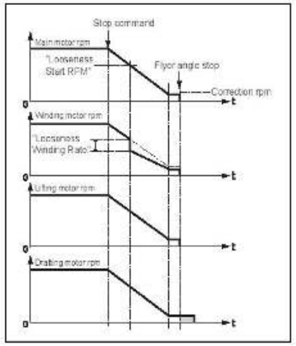
As shown at the left, even after all of the main motor, winding motor and lifting motor have stopped, the drafting motor only continues running until it feeds extra roving preset by the "Roving Looseness at Stop" from the front roller.





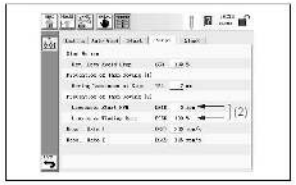
(2) Setting the related items
The "roving looseness at stop" can be modified in the "Stop 1" window called up by selecting FUNCTION | Sequence.

[1-2] Prevention of thin roving irregularity for the deceleration time

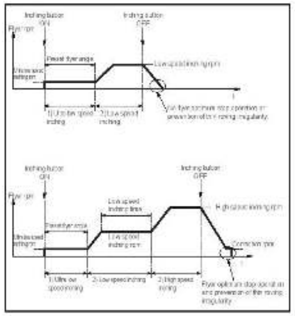

Stop command
Main motor rpm
"Looseness
Start RPM"
Flyer angle stop
Correction rpm
0
t
Winding motor rpm
"Looseness
Winding Rate"
0
t
Lifting motor rpm
0
t
Drafting motor rpm
0
t

(1) Operation sequence
As shown at the left, during deceleration, after the main motor rpm decreases below the preset "Looseness Start RPM," the winding motor rpm decreases by the preset "Looseness Winding Rate" to reduce the winding amount, thus producing roving looseness.
To decrease the winding motor rpm by 10%, for example, set the "Looseness Winding Rate" to 90%. To disable the prevention of thin roving irregularity, set the rate to 100%.

NOTE: Usually enabling the prevention of thin roving irregularity for the time of motion stop only is sufficient. The prevention for the deceleration time is effective for roving of fibers with large passage resistance such as synthetic fiber.



(2) Setting the related items
The "looseness start RPM" and "looseness winding rate" can be modified in the "Stop 1" window called up by selecting FUNCTION | Sequence.



[2] Inching (Ultra low, Low, or High speed)

When a stop motion, (e.g., roving breakage and roving breakage at middle) occurs, restarting the machine after simply taking corrective measure would often lead to another stop motion due to unstableness of the winding condition.
To avoid such stop motions, after taking usual corrective measures, perform inching while watching the roving operation until the usual winding conditions are restored.

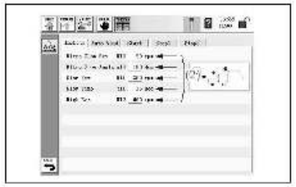
(1) Operation sequence

1) Ultra low speed inching
Pressing the Inching button starts the FL at ultra low speed (preset). The FL keeps inching at the same speed as long as the Inching button is held down.
After ultra low speed inching until the preset "Flyer angle," the FL shifts to low speed inching.

NOTE: Releasing the Inching button during ultra low speed inching enables the flyer stop angle to be adjusted arbitrarily.

2) Low speed inching
After shifting to low speed inching, the FL keeps inching at low speed (preset) during the slow time (preset).
After the slow time elapses, the FL shifts to high speed inching.
Releasing the Inching button during acceleration to low speed inching or during low speed inching decelerates the FL to a stop. No flyer optimum stop operation or prevention of thin roving irregularity will be performed.

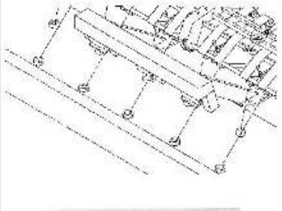
3) High speed inching
After shifting to high speed inching, the FL keeps inching at high speed (preset) as long as the Inching button is held down.
Releasing the Inching button during acceleration to high speed inching or during high speed inching decelerates the FL to a stop. Flyer optimum stop operation and prevention of thin roving irregularity will be performed. (Flyer optimum stop operation can be enabled or disabled.)

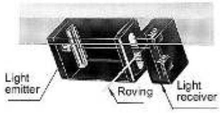


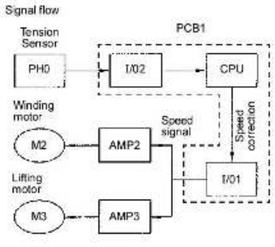
(2) Setting the related items
The following data can be modified in the "Inching" window called up by selecting FUNCTION | Sequence.

- Ultra low speed rpm (Ultra Slow Rev.)
- Ultra low speed angle (Ultra Slow Angle)
- Low speed rpm (Slow Rev.)
- Low speed time (Slow Time)
- High speed rpm (High Rev.)

[3] Correction of Winding Tension




Light emitter
Roving
Light receiver

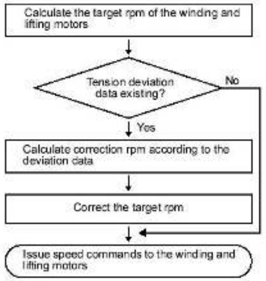

Signal flow
Tension Sensor
PCB1
PH0
I/02
CPU
Winding motor
Speed signal
Speed correction
M2
AMP2
I/01
Lifting motor
M3
AMP3

The FL detects the roving position to an accuracy of 0.11 mm with the CCD sensor and automatically controls the roving tension according to the setting. (For details about the tension sensor, refer to Section 7.1.2, [8].)

(1) Operation sequence

1) Sampling
The FL microprocessor reads in roving position signals each time the strobe signal is issued (at 2-msec intervals) to detect the roving position.
That is, the microprocessor updates the roving position data for three heads at 6-msec intervals.

2) Roving tension control
During roving operation excluding acceleration and deceleration, the FL controls the roving tension by constantly comparing the actual roving position data with the preset target position data.


Calculate the target rpm of the winding and lifting motors
Tension deviation data existing?
No
Yes
Calculate correction rpm according to the deviation data
Correct the target rpm
Issue speed commands to the winding and lifting motors

(2) Roving tension control details

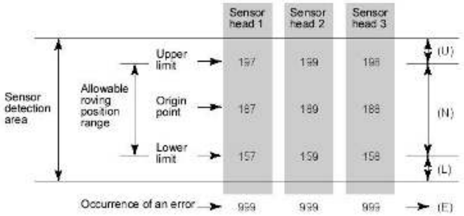
The FL monitors the roving tension with the 3-head tension sensor and controls it. Each head of the tension sensor has a 28-mm detection area which is monitored by 0.11-mm resolution; that is, at 256 positions expressed by 8 bits.

1) Calculating the average roving tension based on the data detected by three sensor heads

The allowable roving position range is defined within the sensor detection area as follows.

Upper limit: 1.1 mm (10 bits) above the origin point
Lower limit: "Tension discrimination factor" below the origin point
(The microprocessor gets the average from the tension data detected by sensor heads where the roving is within the allowable roving position range.)

(Example) If the tension discrimination factor value is 3.3 mm:



(Description of symbols)

The controller divides the sensed data into four groups--U, N, L, and E.

U: Denotes that roving is passing above the upper limit.
N: Denotes that roving is passing through the allowable range.
L: Denotes that roving is passing below the lower limit.
E: Denotes an error. Roving is passing outside the detection area or no detection is possible due to the dirty head.
$\overline{N}$: Denotes that roving is passing outside the allowable range (N); that is, (U), (L), or (E).

For example, "LLE" means that roving position is "L" on heads 1 and 2, and "E" on head 3.

(Interpretation of detected data)

In the description below, A = Detected data on head 1; B = Detected data on head 2, and C = Detected data on head 3.

(3) If roving position is "N" on one or more heads, the controller calculates the average of "N."
If $NN\underline{N}$, (A + B + C)/3
If $N\underline{NN}$, (A + B)/2
If NNN, A

(4) If roving position is not "N" on the three heads but it is "L" on one or more heads (note that there should be no "U"), the controller calculates the average of "L."
If LLL, (A + B + C)/3
If LLE, (A + B)/2
If LEE, A

(5) If roving position is "U" on one or more heads (except when there is "N") as listed below, the controller interprets it as invalid.

UUU, UUE, UEE, UUL, ULL, UEL, etc.

(6) If roving position is "E" on all three heads as listed below, the controller interprets it as invalid.

EEE

2) Handling abnormal data

(1) Roving above the upper limit ("U")
If the controller detects roving passing above the upper limit (origin point + 10 bits) for three successive seconds on any one of the three heads during ordinary operation, it issues any of the following alarm messages and stops roving operation (with the shoulder-stop avoiding function activated).

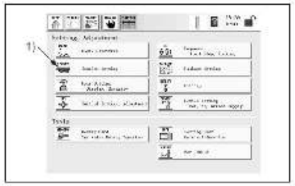
(2) Error data ("E") including roving breaks, loose roving, sensor failure, etc.
If the controller detects the change from normal to error data (Note 1) and keeps detecting the error data for 10 successive seconds on the three heads during ordinary operation, it issues any of the following alarm messages and stops roving operation (with the shoulder-stop avoiding function activated).

(Note 1) If the FL is started with an error being detected, the controller will not detect the error.

■ Alarm messages

For head 1: "E-30 Tension Sensor Head 1 is Abnormal"
For head 2: "E-31 Tension Sensor Head 2 is Abnormal"
For head 3: "E-32 Tension Sensor Head 3 is Abnormal"

You can clear these messages by pressing the Alarm Reset key.



(3) Setting the related items

1) Selecting FUNCTION | Tension Setting allows the user to specify a variety of tension control items.

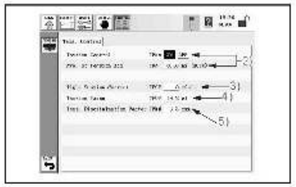
2) The user can enable or disable the tension control and specify the tension target position. (For details, refer to Section 6.1.2.)

3) "Tight Tension Correct"
This tension correction factor modifies the control effect of the tight-to-loose tension relative to the effect of loose-to-tight tension.

Example: If 2.0 x Gain is specified:
The effect of tight-to-loose tension becomes double that of loose-to-tight tension.

4) "Tension Param."
This factor is used to automatically calculate the tension target value. Increasing this factor decreases the tension target value. Usually no change is required.

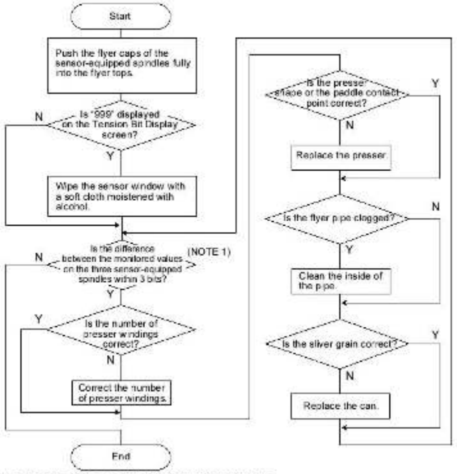
5) "Tens. Discrimination Factor"
This factor is used to define the allowable roving position range as described in "(2) Roving tension control details."



(4) Checking if the tension sensors are normally working during roving operation

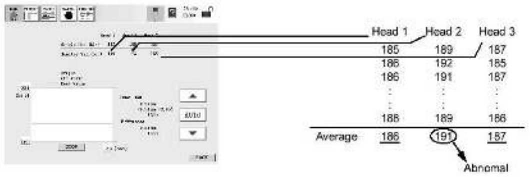
For early detection and prevention of possible problems, it is recommended that periodical checking be performed during roving operation with the following flowchart.

Checking flowchart


Start
Push the flyer caps of the sensor-equipped spindles fully into the flyer tops.
Is '999' displayed on the Tension Bit Display screen?
N
Y
Wipe the sensor window with a soft cloth moistened with alcohol.
Is the difference between the monitored values on the three sensor-equipped spindles within 3 bits?
(NOTE 1)
N
Y
Is the number of presser windings correct?
Y
N
Correct the number of presser windings.
Is the presser shape or the paddle contact point correct?
Y
N
Replace the presser.
Is the flyer pipe clogged?
N
Y
Clean the inside of the pipe.
Is the sliver grain correct?
Y
N
Replace the can.
End

(NOTE 1) How to check the difference between the monitored values

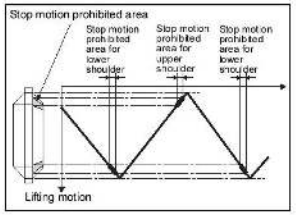
Make a note of the monitored values of each head shown on the Tension Bit Display screen during roving of a layer. Take an average of those monitored values for each of the heads. Compare the three average values with each other.
The example below shows that the average value of head 2 is greatly different from other averages.



	Head 1	Head 2	Head 3
	185	189	187
	186	192	185
	186	191	187
	:	:	:
	:	:	:
	186	189	186
Average	186	191	187

[4] Prevention of Roving from Coming Off the Shoulder of Bobbin

During an ordinary roving state, the FL reverses the bobbin rail at the end of each layer of winding and forms a bobbin of roving until it is fully packaged. If the FL stops in the vicinity of the bobbin rail reversing position or the bobbin rail reverses when the flyer rpm is extremely low, then the roving at the shoulder may come off from the normal wound position in the direction of the cone.
To prevent roving from coming off, if a stop motion is triggered with roving being just in front of the shoulder, the FL continues to run so that the bobbin rail comes out of the domain (stop motion prohibited area) where the bobbin rail reverses with the flyer rpm being low. After that, the FL stops itself.


Stop motion prohibited area
Stop motion prohibited area for lower shoulder
Stop motion prohibited area for upper shoulder
Stop motion prohibited area for lower shoulder
Lifting motion

(1) Operation sequence

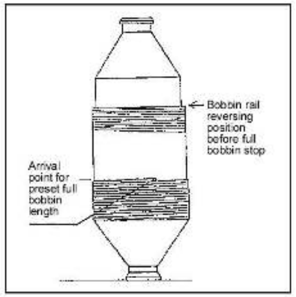
1) If the FL detects a stop signal during ordinary roving operation, it immediately decelerates to a stop.

2) If the bobbin rail lies in the stop motion prohibited area (thick-lined domain in the diagram shown at left), however, the FL will not start deceleration immediately even if it detects a stop signal. After the bobbin rail comes out of the stop motion prohibited area, the FL decelerates to a stop.

(2) Setting the related items
The stop motion prohibited area is specified not with the bobbin rail position but with the ratio of the flyer rpm.
The FL microprocessor automatically operates to determine the stop motion prohibited area (thick-lined domain in the diagram shown at left) where the bobbin rail reverses with the flyer rpm being low.
To modify the stop motion prohibited area, change the "Rev. Rate Avoid Stop" value in the "Stop 1" window called up by selecting FUNCTION | Sequence.

NOTE: If the "Rev. Rate Avoid Stop is set to 80%:
When the FL is running with the flyer speed 1000 rpm, the stop motion prohibited area is set up so that the bobbin rail does not reverse when the flyer speed is 800 rpm or less.

[5] Constant Length & Constant Position Stop


Bobbin rail reversing position before full bobbin stop
Arrival point for preset full bobbin length

At the time of a full bobbin stop, many of conventional roving frames are generally designed to start a stop motion when they arrive at the preset position after passing the point of the preset full bobbin length. This results in an error of maximum two layers of winding in length.

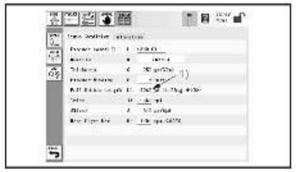
This FL is designed to appropriately correct the bobbin rail reversing position before making a full bobbin stop so that roving comes to the preset stop position at the time of almost completion of roving of full bobbin length, thus improving the yield.

(1) Operation sequence

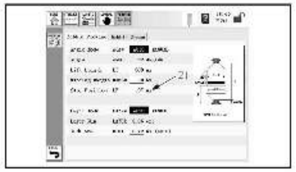
1) When the roving length comes to be three layers short of the preset full bobbin length during roving operation, the microprocessor operates to determine the bobbin rail reversing position at the upper shoulder so that the bobbin rail reaches the preset position at the time of roving completion of the preset length. At the determined reversing position, the bobbin rail starts reversing.

2) At the lower shoulder, the bobbin rail reverses at an ordinary reversing position. When roving reaches almost the preset full bobbin length, the bobbin rail comes to the preset stop position and roving operation stops.

(2) Setting the related items



1) Full bobbin length
The full bobbin length can be specified in the "Basic Condition" window called up by selecting FUNCTION.

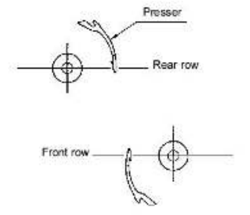


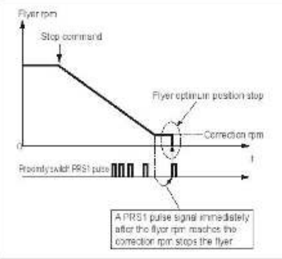
2) Full bobbin stop position
The full bobbin stop position can be specified in the "Bobbin Package" window called up by selecting FUNCTION.

[6] Flyer Optimum Position Stop

At a normal stop (triggered by a stop motion, by pressing the Stop button, or by releasing the Inching button during high speed inching) halfway through roving operation, the flyer optimum position stop function stops the FL always with the constant flyer angle to facilitate the roving piecing operation for the operator.
Also at a full-bobbin stop, this flyer optimum position stop function prevents the roving end from getting pulled and broken by the presser end due to the flyer stopped at the wrong angle during manual doffing or automatic doffing (with TRD).

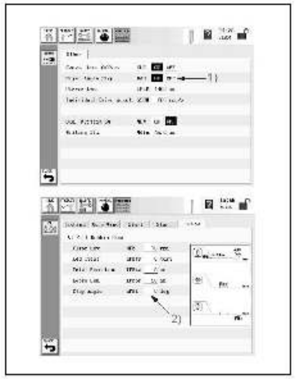
Flyer optimum position at doffing





(1) Operation sequence
At a normal stop halfway through roving operation, the flyer decelerates to the correction rpm. It rotates at that rpm until the proximity switch PRS1 pulse is detected.
Also at a full-bobbin stop, the flyer optimum position stop function works under the same control as at a normal stop. Note that it is possible to adjust the flyer stop angle by delaying the stop angle from that at a normal stop.

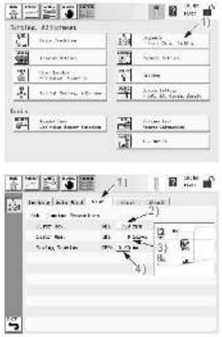
(2) Adjustment of proximity switch
Refer to Section 3.1.3, [11].



(3) Setting the related items

1) Enabling or disabling the flyer optimum stop function at a normal stop
The "flyer optimum stop function" can be enabled or disabled in the "Others" window called up by selecting FUNCTION | Initial Setting. Selecting ON enables the function.

2) Adjusting the flyer stop angle
The delay angle for the flyer stop angle at a full-bobbin stop can be specified in the "Stop 2" window called up by selecting FUNCTION | Sequence.



[7] Prevention of Bobbin Jumping

If the flyer speed (rpm) preset for the start of roving is high, bobbins will be pulled up by roving at the reverse time around lower shoulders during lifting operation, resulting in jumped-out bobbins.

To prevent bobbin jumping, you can set the low-speed start sequence in which the FL runs at the low flyer speed until the preset number of layers is produced and then it runs at the regular flyer speed.

(1) Operation sequence

1) After the start of operation, the FL accelerates the flyer speed up to the rpm preset for the bobbin jumping prevention.
   If the automatic winding is selected, the FL first carries out the automatic winding operation and then applies the bobbin-jumping prevention speed.

2) The FL keeps the bobbin-jumping prevention speed until the preset number of layers is produced.

3) The FL starts accelerating the flyer speed up to the regular one.

(2) Setting procedure

1) Select the "Start" window called up by selecting FUNCTION | Sequence.

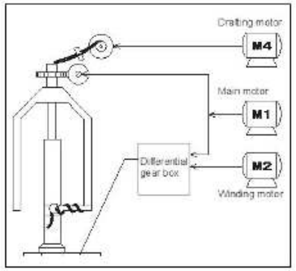
2) Flyer speed (rpm)
   Set the low flyer speed to the extent that bobbins do not jump.

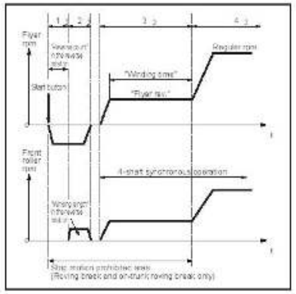
3) Number of layers
   Setting "0" to this item disables the bobbin-jumping prevention function so that the regular operation applies.

4) Roving tension (mm)
   Set the roving tension to be applied during bobbin-jumping prevention sequence. Be sure to set higher tension than usual. Otherwise, roving will be loosely wound due to the low flyer speed and later the previously wound layers will bulge out.

[8] Automatic Winding of Roving

After full-bobbin doffing, the end of roving is cut at a few centimeters from the end of the presser. At the start of operation, the end of the roving is pressure-bonded to the taped section of a bobbin. Starting the operation automatically winds the roving around the bobbin.





(1) Operation sequence

1) At the empty-bobbin winding start position after doffing, pressing the Start button starts flyer reverse operation.
During this operation, no roving is fed or wound.

2) After the flyer rotates by the preset number of turns in the reverse direction ("Reverse count"), the FL performs the drafting and winding operation while keeping the flyer reverse operation to wind the roving by the preset winding length.

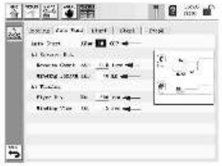
3) The FL stops its operation once. Then the flyer rotates in the forward direction and the FL enters the 4-shaft synchronous operation in which the preset flyer speed (rpm) and winding time apply. (Until the roving tension is stabilized, the FL runs at low speed.)

4) After that, the flyer speed increases up to the regular one.

NOTE: During the operation in steps 1) through 3), a stop motion except a sliver break is prohibited.

NOTE: At the empty-bobbin winding start position after doffing, performing inching before pressing the Start button cancels automatic winding of roving.

The FL starts in the same way as the restart operation halfway through roving.



(2) Setting the related items

The following related data be modified in the "Auto Wind" window called up by selecting FUNCTION | Sequence.

"Reverse count" in the reverse rotation
"Winding length" in reverse rotation
"Flyer rev." for automatic winding
"Winding time" for automatic winding

XXXXXXXXXXXXXXXXXXXXXXX

[9] Operation of Cleaning Unit

The FL has a CWC (as standard) and a blower cleaning unit (as option) that keeps the flyer rail cover clean.

OPERATION:

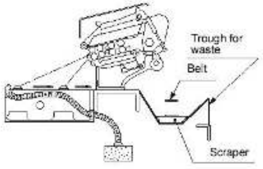
If the CWC motor runs, the CWC belt works with the scraper to convey waste accumulated in the trough into the dust box.

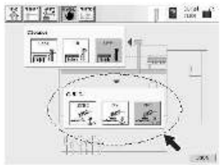
At the same timing as for the CWC motor, the optional blower motor starts to run.

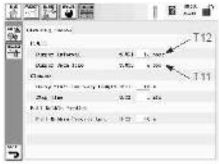
To activate or deactivate the CWC unit, call up the Cleaner window on the MANUAL screen and select SYNC, ON, or OFF at the CWC. window.

- If you select SYNC, the CWC unit will run or stop synchronized with the start or stop of the FL.
- Selecting ON runs the CWC unit independently of the FL operation.
- Selecting OFF immediately stops the CWC unit if in operation.

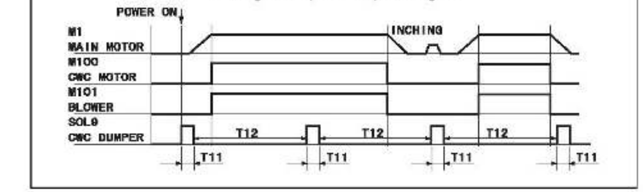
If the FL is equipped with an optional centralized waste collector, waste gathered by the CWC unit will be collected into the centralized waste collector by opening the dumper of the dust box.
The dumper interval can be specified in the "Cleaning Device" window called up by selecting FUNCTION | Device Setting.

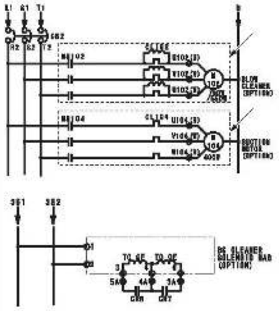

Trough for waste
Belt
Scraper





Cleaning device operation sequence diagram


POWER ON
M1
MAIN MOTOR
M100
CWC MOTOR
M101
BLOWER
SOL9
CWC DUMPER
INCHING
T12
T12
T12
T11
T11
T11
T11


R1
S1
T1
CB2
R2
S2
T2
MS102
OL102
U102(3)
V102(3)
W102(3)
M
102
BLOW
CLEANER
(OPTION)
MS104
OL104
U104(3)
V104(3)
W104(3)
M
104
SUCTION
MOTOR
(OPTION)
3S1
3S2
TO GE
TO OE
3
4
5A
4A
3A
CRR
CRT
BS CLEANER
SOLENOID PAD
(OPTION)

[10] Blow Cleaner (BS or D type)

The FL can be optionally equipped with a blow cleaner (BS or D type) that collects fluff from the roller part' clearer and cleans the roller part by blowing air.

The BS or D type usually stays in the standby position. The moment the staying time ("Stop Time") preset on the function panel has elapsed, it travels to the opposite side of the standby position and comes back to the standby position. The BS or D type repeats this shuttle operation.

(1) Basic operation

1) BS type

a. The moment the "Stop Time" preset on the function panel has elapsed, the electromagnetic contactor MS102 is excited.

b. Then MS102 excites motor M102 and the cleaner main unit starts traveling on the tangential belt.

c. If the cleaner reaches the end of the suction side, it turns ON the proximity switch PRS***, thereby turning the relay CR8 ON.

d. The CR8 excites the solenoid magnet SOL to shift the belt so that the cleaner returns to the standby position where the proximity switch PRS*** is turned ON. Thereby, the motor M102 is turned OFF.

PRS***	OE proximity switch: PRS020
	GE proximity switch: PRS021

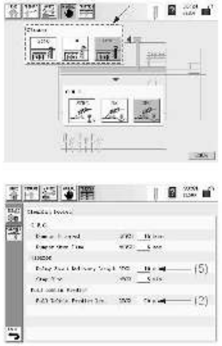
2) D type

a. The moment the "Stop Time" preset on the function panel has elapsed, the electromagnetic contactor MS102 is excited.

b. The MS102 excites the motor M102 so that the cleaner unit starts traveling on the tangential belt.
(The reverse operation of the D type is caused by mechanically shifting the tangential belt.)

c. When the cleaner approaches its standby position, it turns ON the limit switch LS21, thereby turning OFF the motor M102 to stop the cleaner.

d. Upon lapse of the retract time, motor M102 is turned ON again to start the cleaner body to run. (In the D type cleaner, the tangential belt is mechanically shifted to reverse the operating direction.)



(2) Pre-full bobbin operation
When the FL continues roving operation and the roving delivery reaches the preset full bobbin prediction length, the cleaner immediately returns to the standby position. That is, if the cleaner is traveling towards the opposite of the standby position, it reverses the traveling direction to return to the standby position; if it is traveling to the standby position, it proceeds in the same direction.

(3) Start and stop of cleaner operation
Call up the Cleaner window on the MANUAL screen and select SYNC, ON, or OFF.

- When SYNC is selected, the cleaner can be operated synchronously with the FL operation.
- When ON is selected, the cleaner will be started and stopped independent of the FL operation.
- When OFF is selected, the cleaner is stopped forcibly.

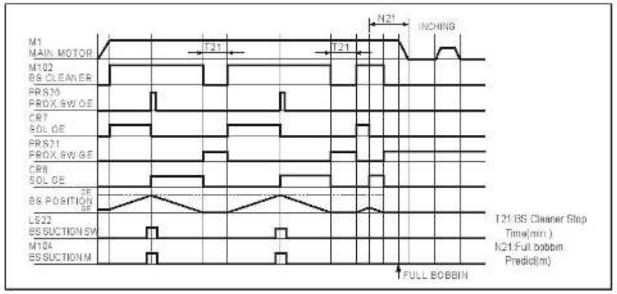
(4) Suction operation (option)

- When the cleaner unit approaches the OE, limit switch LS22 is turned ON to energize electromagnetic switch MS104.
- MS104 then turns on suction motor M104. The cleaner collects fluff in the cleaner body into the dust box.
- In the case of BS type, when the cleaner unit is reversed to move away from the OE, the LS22 is turned OFF so that the M104 is turned OFF.
- In the case of D type, after the LS22 is turned ON, the M104 is turned ON only for 20 seconds.

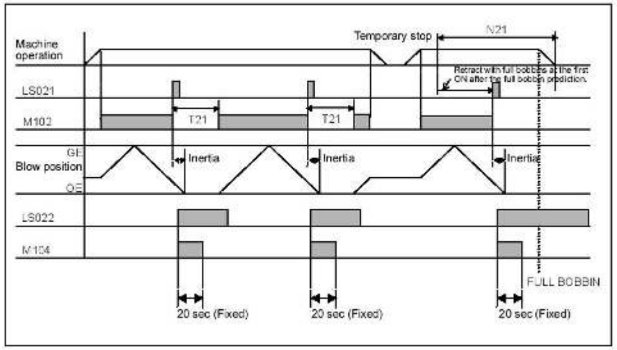
(5) Delayed starting
In synchronous operation, it is possible to delay the start of cleaner operation until the roving delivery reaches the preset "Delay Start Delivery Length." This is called delayed starting.
Set the "Delay Start Delivery Length" on the Cleaning Device window called up by selecting FUNCTION.

(6) Cleaner operation sequence diagram

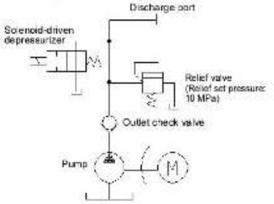
- **BS type cleaner**


N21
INCHING
M1
MAIN MOTOR
T21
T21
M102
BS CLEANER
PRS20
PROX.SW.OE
CR7
SOL OE
PRS21
PROX.SW.GE
CR8
SOL OE
GE
BS POSITION
BF
LS22
BS SUCTION SW
M104
BS SUCTION M
FULL BOBBIN
T21:BS Cleaner Stop Time(min.)
N21:Full bobbin Predict(m)

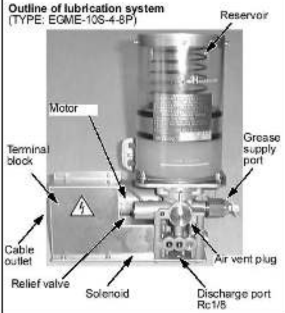
- **D type cleaner**


Temporary stop
N21
Machine operation
Retract with full bobbins at the first ON after the full bobbin prediction.
LS021
M102
T21
T21
GE
Blow position
OE
Inertia
Inertia
Inertia
LS022
M104
FULL BOBBIN
20 sec (Fixed)
20 sec (Fixed)
20 sec (Fixed)

Circuit diagram of lubrication system


Discharge port
Solenoid-driven depressurizer
Relief valve (Relief set pressure: 10 MPa)
Outlet check valve
Pump
M

Outline of lubrication system
(TYPE: EGME-10S-4-8P)


Reservoir
Motor
Terminal block
Grease supply port
Cable outlet
Air vent plug
Relief valve
Solenoid
Discharge port Rc1/8

[11] General Lubrication

This system lubricates the flyer gears, draft gearing and bobbin gears automatically or manually.
Respective drive systems are equipped with an electric pump that makes reciprocating piston movement with the motor.

(1) Operation

1) An automatic lubrication operation in which the electric pump is activated starts at the doffing timing (when the bobbin rail comes to the doffing position) after the preset lubrication interval T51.

2) The elapsed time is counted with the cumulative main motor ON time. The counter will be reset when an automatic lubrication operation is performed.

3) On the MANUAL screen are manual lubrication switches which allow you to manually drive the electric pumps at the flyer gear side and bobbin gear side independently.

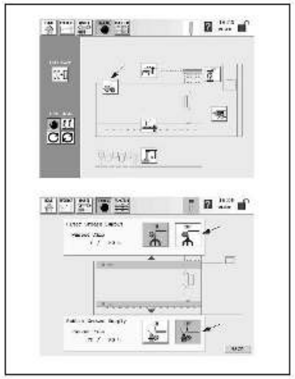
4) Operating conditions and functions

a. Lubrication is possible only when the FL is on halt.
Pressing the FL Start button with pumps working displays the following error message.
"W-67 During greasing"

b. The lubricating period can be specified on the function panel.

c. Turning the manual switch ON drives the corresponding motor. If the preset lubrication period has elapsed, the motor will be turned OFF automatically.
The remaining time of the lubricating period appears below the corresponding switch.
Pressing the manual switch when the motor is driven turns the motor OFF.

NOTE: In the case of manual lubrication also, the cumulative counting time will be reset.



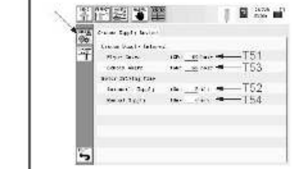
5) Display of elapsed time (cumulative)
The elapsed time/Preset time (hours) can be monitored on the window called up by selecting MANUAL | GREASE.
If the lubrication cycles for the flyer and bobbin sides are overlapped, lubrication for the flyer side has priority and the bobbin side will be lubricated at the next doffing timing.

(2) Specifying the lubrication intervals

The flyer and bobbin lubrication intervals are specified in hours, based on the maximum flyer speed (rpm) in the flyer speed change pattern.

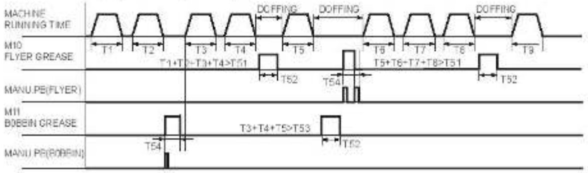
The lubrication intervals can be specified on the Grease Supply Device window called up by selecting FUNCTION | Device Setting | GREASE.

Maximum flyer revolution (rpm)	Lubrication intervals (hours)	Grease supply intervals for lubricating pump (hours)
1400 to 1500	24	667
1300 to 1399	30	833
1200 to 1299	60	1667
1100 to 1199	90	2500
1000 to 1099	120	3333
to 999	150	4167


T51
T53
T52
T54

T51:Flyer gear lubricating cycle
T52:Flyer gear electric pump operating time
T53:Bobbin gear lubricating cycle
T54:Bobbin gear electric pump operating time
T1 to T9:Time from empty bobbin to full bobbin

General lubricating operation sequence diagram


MACHINE RUNNING TIME
M10 FLYER GREASE
MANU.PB(FLYER)
M11 BOBBIN GREASE
MANU.PB(BOBBIN)
DOFFING
DOFFING
DOFFING
T1
T2
T3
T4
T5
T6
T7
T8
T9
T1+T2+T3+T4>T51
T52
T54
T5+T6+T7+T8>T51
T52
T3+T4+T5>T53
T54
T52

[12] Grease Hydraulic Pressure Detection

A hydraulic pressure sensor is provided in the middle of the lubrication route of the centralized lubrication system which supplies grease to the flyer gears, draft gearing and bobbin drive gears automatically or manually. This sensor signals if a problem happens in the lubrication route.

OPERATION:

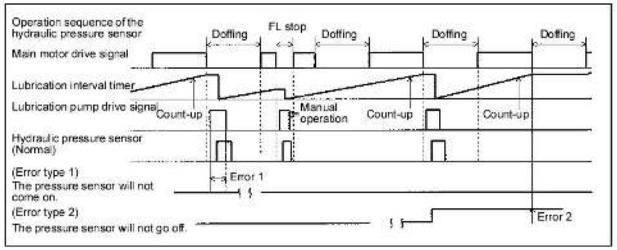
(1) The moment the lubrication motor (for flyer and bobbin drive gears) is turned on, the controller starts monitoring the hydraulic pressure for rise (monitoring the hydraulic pressure sensor ON state), regardless of whether automatically or manually.
If the hydraulic pressure sensor has not been turned ON once until the stop of the lubrication motor, the controller regards it as an error (Error type 1).

- Either of the following messages appear. { "E-17A Flyer greasing error (Pressure remains Lo)"
  "E-17B Bobbin greasing error (Pressure remains Lo)"
- The red lamp of the signal indicator flashes. (The FL cannot run.)

(2) Before the lubrication motor is turned on, the controller checks that the hydraulic pressure sensor is OFF. If the hydraulic pressure sensor is ON, the controller regards it as an error (Error type 2).

- Either of the following messages appear. { "E-18A Flyer greasing error (Pressure remains Hi)"
  "E-18B Bobbin greasing error (Pressure remains Hi)"
- The red lamp of the signal indicator flashes. (The FL cannot run.)

ACTION: See Section 8.1 "Troubleshooting."
Press the Alarm Reset switch to remove the error.


Operation sequence of the hydraulic pressure sensor
Doffing
FL stop
Doffing
Doffing
Doffing
Main motor drive signal
Lubrication interval timer
Lubrication pump drive signal
Count-up
Manual operation
Count-up
Count-up
Hydraulic pressure sensor (Normal)
(Error type 1)
The pressure sensor will not come on.
Error 1
(Error type 2)
The pressure sensor will not go off.
Error 2

[13] Oil Circulation Detection

The oil pump circulates oil from the oil tank of the lifting gear box to the lifting gear box and the differential gear box.
A pressure switch is provided in the middle of this circulation channel for checking the oil pressure. Warning will be output if any abnormality is detected in the circulation channel.

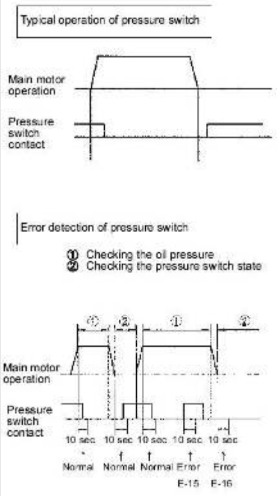
OPERATION:

(1) When the FL is in ordinary operation except during acceleration and deceleration, the controller always monitors the oil pressure. If the pressure switch contact stays ON (meaning no pressure in the circulation channel) for 10 seconds, the controller regards it as an error.
   - The error message "E-15 Oil Pressure is Lower" appears.
   - The red lamp of the signal indicator flashes and the FL comes to a stop

(2) When the FL is on halt, the controller always monitors the oil pressure. If the pressure switch contact stays OFF (meaning pressure in the circulation channel) for 10 seconds, the controller regards it as a sensor error.
   - The error message "E-16 Oil Pressure SW is Troubled" appears.
   - The red lamp of the signal indicator flashes and the FL cannot run.

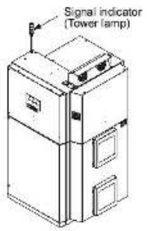
   (The same error message shown above appears if the pressure switch is normal but the oil in the circulation channel is actually pressurized for 10 seconds when the FL is on halt.)

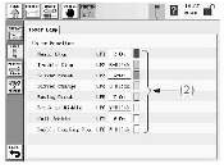
NOTE: The pressure switch used is ON (conducting) when no pressure applies; it is OFF (nonconducting) when pressure applies.
ACTION: See Section 8.1 "Troubleshooting."
After the FL stops, press the Alarm Reset switch to remove the error.


Typical operation of pressure switch

Error detection of pressure switch

① Checking the oil pressure
② Checking the pressure switch state





[14] Signal Indicator (Tower lamp)

The signal indicator is a simplest means of provision of the current FL state.
Unlike the operation panel, it is mounted on the GE to enable the operator at a comparatively remote location to monitor the current FL state.

(1) Specifications:
The signal indicator consists of four color lamps--red, green, yellow, and white. Those lamps can express eight FL states by turning ON or flashing.
The Toyoda standard configuration (default) of those lamps is listed below.

(2) Modification
The function assignment to the four color lamps can be modified on the Tower Lamp window called up by selecting FUNCTION | User Setting | LAMP.

Toyoda Standard Configuration

Function	Color of lamps
Normal stop	Red
Trouble stop	Red flashing
Sliver break	Green
Sliver change	Green flashing
Roving break	Yellow
Break at middle (on-trunk roving break)	Yellow flashing
Full bobbin	White
Empty-bobbin loading position	White flashing

[15] Bottom Bunch Windings (option)

To prevent roving ends from drooping by their own weight during transportation of roving cops, the FL100 may wind roving ends at the bottom of bobbins after bobbins become full. This operation is called "bottom bunch building."

(1) Bottom bunch building sequence

1) When bobbins become full, the four shafts start decelerating synchronously.

2) When the main motor speed reaches the full-bobbin rpm, the bobbin rail starts acceleration in up-movement.

   REFERENCE: Before the bobbin rail starts acceleration, it is possible to make additional twists before bottom bunch winding to loosen roving.

3) When the bobbin rail speed reaches the speed preset for bottom bunch building, the bobbin rail stops accelerating and moves up at constant speed.

4) When the bobbin rail reaches the lower shoulder position, it decreases the speed in proportion of the decrease Φ and the winding speed increases in inverse ratio to the decrease Φ.

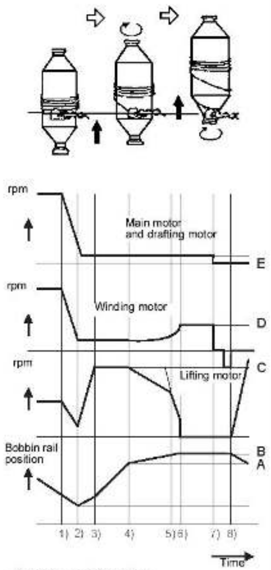
5) The up-movement speed of the bobbin rail switches to that designed for independent rail up-movement mode.

6) When the bobbin rail reaches the bottom bunch position, it stops. Bottom bunch building starts at constant winding speed.

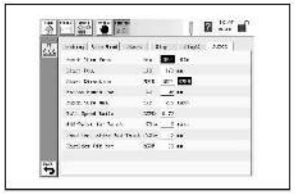
7) Upon completion of bottom bunch building, the FL starts reverse bobbin rotation.

8) Reverse rotation of bobbins ends. The bobbin rail automatically starts moving down.

   NOTE: If preset, additional twists or roving feeding will take place preceding the process 7).



A: Lower shoulder position
B: Bottom bunch position
C: Bobbin rail speed preset for bottom bunch building
D: Winding speed synchronized with empty-bobbin diameter
E: Full-bobbin rpm



(2) Setting the related items

The bottom bunch building items can be configured in the bunch building window called up by selecting FUNCTION | Sequence | Bunch.

- Bunch Turn Func.
  Select "BTM."
- Bottom Bunch Pos.
  Specify the distance from the bottom of bobbins within the range from 0 to 50 mm.
  Reference value: 26 mm
- Bunch Turn Num.
  Specify the number of turns for bottom bunch building.
  Reference value: 2.0 turns

  NOTE: This value should be used as a guide since it slightly varies depending upon the preceding and following operations.
- Rail Speed Ratio
  Specify the ratio of the bobbin rail movement speed during bunch building to the roving speed.
  Reference value: 0.40

  NOTE: If the roving breaks due to too tight tension, increase this value. (Decreasing this value reduces the roving angle to be applied during bunch building.)
- Other adjustments
  The following items are provided to adjust winding during bottom bunch building. Adjust each of those items while checking the actual roving production state.

  1. Start Direction for bunch building
     Usually bunch building starts after a full-bobbin stop (that is, the bobbin rail stops in the direction of down-movement). The start direction is "EVEN."
     Changing the start direction to "ODD" allows bunch building to start in the direction of bobbin rail up-movement.
     Initial value: EVEN

  NOTE: Setting EVEN disables the constant length offset function.

  2. Additional Twists preceding bunch building
     If the number of additional twists and roving feeding length are specified, the related operations are performed before the start of bottom bunch building (that is, before the bobbin rail up-movement in (1) Bottom bunch building sequence, 2)).

3. Shoulder Offset
   This offset is used to adjust the winding state of the lower shoulder during bobbin rail up-movement. Increasing this value results in a loose winding.
   Reference value: 10 mm

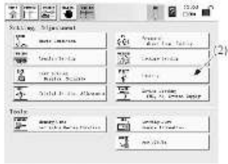
[16] Sliver Cans Change Pattern Function

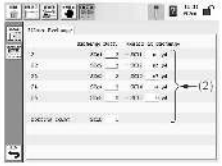
You can set the sliver cans change patterns so that the roving sections corresponding to the seams of slivers (bound together at the replacement of cans) come to the 1st layers on bobbins. This will prevent those roving sections from becoming cops on the FL, minimizing the roving loss.

(1) Summary of Operation

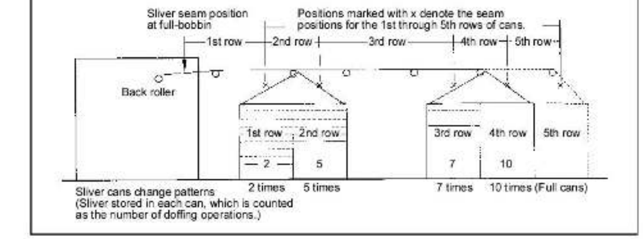
It is assumed that the sliver cans will be changed at the units of rows of cans.

1) For the change of sliver cans, the FL stops in the sliver cans change position before reaching the preset length (full-bobbin). It flashes the signal indicator.
2) After the change of sliver cans, reset the sliver change alarm to stop flashing of the signal indicator and continue running the FL.
3) When the seams of slivers approach the back rollers, the FL comes to a full-bobbin stop.
4) At the start of the next roving operation, the roving sections corresponding to the seams of slivers will be wound on bobbins as 1st layers.





Cans Arrangement (Figure 1)


Sliver seam position
at full-bobbin
Positions marked with x denote the seam positions for the 1st through 5th rows of cans.
1st row
2nd row
3rd row
4th row
5th row
Back roller
1st row
2nd row
3rd row
4th row
5th row
2
5
7
10
Sliver cans change patterns
(Sliver stored in each can, which is counted as the number of doffing operations.)
2 times
5 times
7 times
10 times (Full cans)

(2) Setting the related items

The sliver cans change pattern can be set up in the "Sliver Exchange" window called up by selecting FUNCTION | Utility.

- Be sure to stop the FL when setting up the sliver cans change pattern.

EXAMPLE: Cans arrangement shown in Figure 1

1) Set the number of doffings required to make cans empty at each row.

Z1 [2] Set the number of doffings until the 1st row of cans becomes empty. (2 in this example)

Z2 [3] Set the number of doffings until the 2nd row of cans becomes empty after the completion of the above number of doffings for the 1st row. (3 in this example)

Z3 [2] Set the number of doffings until the 3rd row of cans becomes empty after completion of the above number of doffings for the 2nd row. (2 in this example)

Z4 [3] Set the number of doffings until the 4th row of cans becomes empty after completion of the above number of doffings for the 3rd row. (3 in this example)

Z5 [0] Set the number of doffings until the 5th row of cans becomes empty after completion of the above number of doffings for the 4th row. If this row is not used, set 0. (This example is a 4-row sliver cans change pattern and does not use this 5th row, so set 0.)

Doff Counter [1] At the start of doffing, set 1. This counter counts up by one at every doffing. When it reaches 10, it laps around to 1.

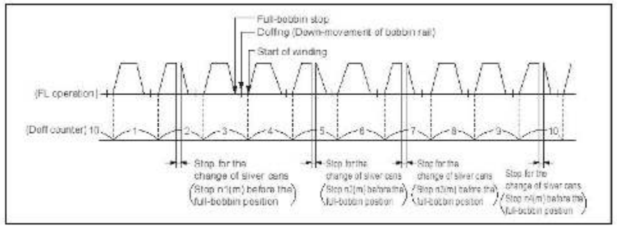
REFERENCE:

- If all of Z1 through Z5 are set to 0, the FL will not stop for sliver cans change. It will stop at every full-bobbin state.
- If (Z1 + Z2 + Z3 + Z4 + Z5) < Doffer counter value, the FL will regard its state as an error.

2) Set the length of sliver remaining at the change time of the sliver cans to each of Z1 through Z5 according to the following calculation:

For each of rows of cans, multiply the sliver length from the seams of slivers to the approach of the back rollers by the total draft ratio. Then, enter the obtained value.

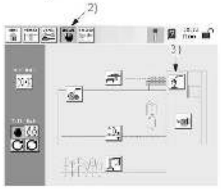
EXAMPLE: Full-bobbin length: 4000 m
Total draft ratio: 8.5
Sliver length from the seams of slivers to the approach of the back rollers at the 1st row of cans: 1.5 m
Then, multiply 1.5 by 8.5 and enter 13 to n1.
In the same manner, obtain the set values for n2 through n5.


Full-bobbin stop
Doffing (Down-movement of bobbin rail)
Start of winding
(FL operation)
(Doff counter) 10
1
2
3
4
5
6
7
8
9
10
Stop for the change of sliver cans (Stop n1(m) before the full-bobbin position)
Stop for the change of sliver cans (Stop n2(m) before the full-bobbin position)
Stop for the change of sliver cans (Stop n3(m) before the full-bobbin position)
Stop for the change of sliver cans (Stop n4(m) before the full-bobbin position)

[17] Roving Assist Function for Roving Specification Change

This assist function facilitates effective setup for producing new specification roving.
Without this function in the conventional setup way, you pass new specification sliver through the draft part, inch the FL to feed roving out by the specified length, and then wind the roving around the Velcro fastening on a bobbin by hand.

With this assist function, after passing new specification sliver through the draft part, just pressing the AUTO button automatically feeds roving from the draft part by the specified length (from the outlet of the front roller to that of the presser through the fryer pipe), and then stops the roving operation. Unlike conventional inching operation, this operation drives the draft part only so that the bobbin rail stays at the winding start position and automatic winding operation is possible at the subsequent startup time.


Manual operation screen

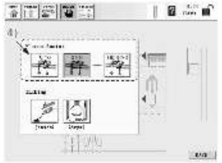
(1) Operating procedure

NOTE: Check the following before proceeding to the setup procedure.

- Sliver is passed through the draft part for all spindles.
- The arm is set into place.
- Empty bobbins are loaded and the bobbin rail is at the winding start position.
- Workers and surroundings are safe.

1) Turn the setting-enable (DATA SET) key to the DATA SET position.

2) In the top menu, touch the MANUAL button to call up the manual operation screen.

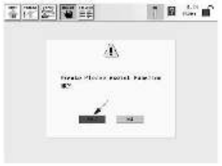

Roving assist window

3) Touch the "Roving" button to call up the roving assist window.

4) Touch the AUTO button. The confirmation window appears. Check for safety and touch Yes to start the fleece assist operation.

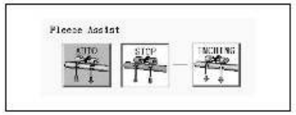
NOTE: To stop it, touch No.

5) The fleece assist operation starts.
During the operation, the draft part rotates in the rpm equivalent to the "low-speed inching speed."
(No flyers, bobbins, or bobbin rail does not function.)


Confirmation window

6) Upon completion of the specified length of roving delivery, the FL automatically stops itself.

NOTE: After the FL stops, start passing the roving through the flyer pipe.



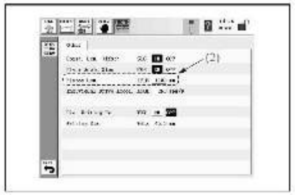
Tip: Other buttons

INCHING button

Use this button to slightly increase roving delivery length. While you touch this button, the fleece assist operation is performed.

STOP button

To stop fleece assist operation half-way, touch this button.



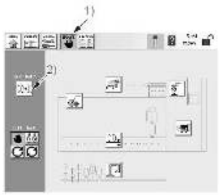
(2) Setting the related items

If the fleece length is greatly different from the expected one during fleece assist operation, the fleece length ("Fleece Len.") can be changed on the "Other" window called up by selecting FUNCTION | Initial Setting and Adjustment.

Reference value: 1400 mm

[18] Halfway Doffing

Manual operation screen



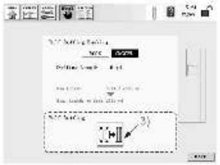
This function causes a forced full-bobbin stop in order to doff bobbins with less length than the preset full-bobbin length for production adjustment.
This function is available in the following two modes.

- Halfway doffing
  Touching the Halfway Doffing button causes a full bobbin stop when the bobbin rail reaches the full bobbin stop position first after the button is touched.
- Halfway doffing booking
  Independent of the regular full-bobbin doffing length, the halfway doffing length effective for the current doffing only can be specified.

Even at a full-bobbin stop caused by this halfway doffing function, additional twisting and bunch building operations, and automatic bobbin rail down-movement are performed, if enabled, just as at a regular full-bobbin stop.

Since this function doffs halfway through roving production, it can be protected with the setting-enable (DATA SET) key against accidental triggering. (For the setting procedure, refer to Section 5.1.10.)

Half Doffing Booking & Half Doffing window

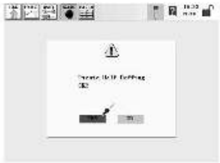


(1) Performing halfway doffing
Halfway doffing is triggered when the bobbin rail reaches the full bobbin stop position first after the following procedure.

Operating procedure

1) In the top menu, touch the MANUAL button to call up the manual operation screen.
2) On the manual operation screen, touch the Half Doffing button to call up the Half Doffing Booking & Half Doffing window.

Confirmation window

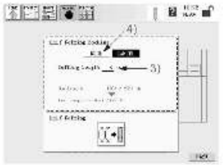


3) Touch the Half Doffing button.
   The confirmation window appears. To proceed, touch YES.

   NOTE: To cancel, touch NO.

4) The FL runs until the bobbin rail reaches the full bobbin position and causes a full bobbin stop.

Half Doffing Booking & Half Doffing window



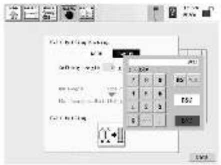
(2) Booking halfway doffing

The following booking procedure specifies the halfway doffing length less than the preset full-bobbin length for the current doffing.

Operating procedure

1) In the top menu, touch the MANUAL button to call up the manual operation screen.
2) On the manual operation screen, touch the Half Doffing button to call up the Half Doffing Booking & Half Doffing window.

Setting the doffing length

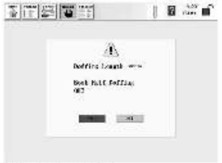


3) Specify the desired halfway doffing length.
   The current roving length (preset full-bobbin length) and the allowable minimum roving length are displayed as a guide.

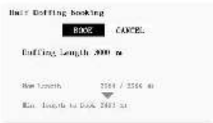
Current roving length (Now Length)	29/3500m
▼	
Minimum roving length (Min. Length to Book)	84m

NOTE: The minimum roving length displayed is used as a guide for assuring the roving length required for the constant length & constant position stop.

Confirmation window



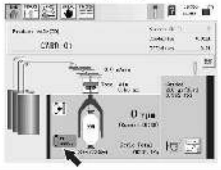
Doffing being booked



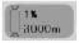
4) Select BOOK
The confirmation window appears. To proceed, touch YES.

NOTE: To cancel, touch NO.

Main screen (Doffing being booked)



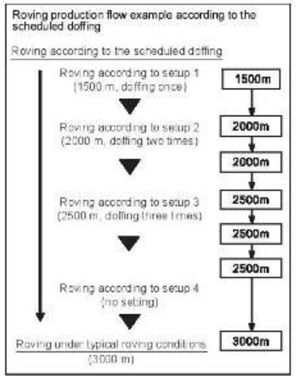
5) When the halfway doffing is booked, the booked state is shown on the main screen with an icon given below.



6) The FL causes the constant length & constant position stop according to the specified halfway doffing length.
The message "Booked Stop" appears.

NOTE: Causing the booked stop once automatically cancels that booking.

[19] Scheduled Doffing


Roving production flow example according to the scheduled doffing

Roving according to the scheduled doffing
Roving according to setup 1
(1500 m, doffing once)
1500m
Roving according to setup 2
(2000 m, doffing two times)
2000m
2000m
Roving according to setup 3
(2500 m, doffing three times)
2500m
2500m
2500m
Roving according to setup 4
(no setting)
Roving under typical roving conditions
(3000 m)
3000m

This function supplies roving according to schedule for preparation of roving setup change and other production adjustment.

Using this function eliminates the conventional full-bobbin length setting change required every doffing end and the worker's doffing start procedure halfway through roving operation. It enables scheduled roving production just by configuring the schedule once.

(1) Summary of Operation

Figure 1 shows the roving production flow when the scheduled doffing is used.

Configuration example

- Full-bobbin length under typical roving conditions: 3000 m
- Setup 1: Full-bobbin length = 1500 m, Doffing count = once
- Setup 2: Full-bobbin length = 2000 m, Doffing count = 2 times
- Setup 3: Full-bobbin length = 2500 m, Doffing count = 3 times
- Setup 4: No setting

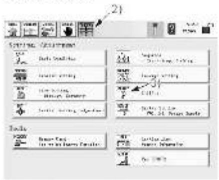
1) According to setup 1, doffing once with full-bobbin length 1500

2) According to setup 2, doffing two times with full-bobbin length 2000

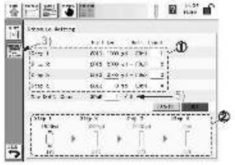
3) According to setup 3, doffing three times with full-bobbin length 2500

4) After that, roving under typical roving conditions (full-bobbin length 3000 m)

FUNCTION menu



Scheduled Doffing window



(2) Setting the related items

1) Turn the setting-enable (DATA SET) key to the DATA SET position.

2) In the top menu, touch the FUNCTION button to call up the function menu.

3) Touch the "Utility" button and then touch the SCHEDULED DOFFING button in the sub menu. The Scheduled Doffing window appears.

4) In area ① of the Scheduled Doffing window, enter the desired values to the full bobbin length and the doffing count fields for each of Setups 1 through 4

NOTE: For unused setups, enter 0 to those fields.

5) Enter 1 to the current doff count (Now Doff. Count).

NOTE: Entering 0 to the current doff disables the scheduled doffing.

NOTE: Entering any value other than 0 and 1 starts the scheduled doffing from that doffing count.

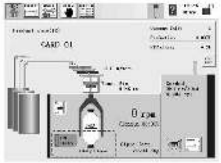
NOTE: The denominator of the current doff count indicates the total number of doff counts of Setups 1 through 4.

NOTE: The scheduled doffing settings made here go into effect for the next roving sequence.

NOTE: The current doff count indicates the currently doffing count and it will be automatically updated.

- After completion of the scheduled doffing by the total number of doff counts, the current doff count will be automatically reset to 0.

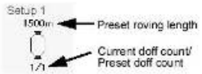
Main screen (Scheduled doffing in progress)


CARD 01
0 rpm

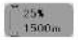
(3) Status display

The current status of the scheduled doffing being in progress can be monitored on the following screens.

- Scheduled Doffing window
  Area ② shows the current setups and their doff counts.


Setup 1
1500m
1/1
Preset roving length
Current doff count/
Preset doff count

- Main screen
  When scheduled doffing is in progress, an icon given below appears on the main screen.

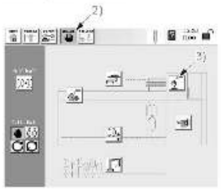


Upper row:
  Wound percentage to the full bobbin length in scheduled doffing

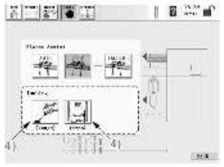
Lower row:
  Preset roving delivery length in scheduled doffing

NOTE: The wound percentage and delivery length under typical roving conditions are displayed as usual.

Manual operation screen



Roving assist window



[20] Manual Roving Loosening Function

This function allows the worker to loosen roving manually in order to avoid the following incidents that are likely to happen if roving remains too tense for a long time when the FL is on halt halfway through roving operation.

- Causing thin roving irregularity
- Roving break at the restart time depending upon roving specification

Roving can be loosened at the following two positions.

- Between the front roller and flyer cap (draft forward inching)
- Between the presser and bobbin of roving (bobbin reverse inching)

This manual roving loosening function is also used for doffing of small cops in order to smoothly cut roving at the time of bobbin rail down-movement by loosening roving between the presser and bobbin of roving.

Operating procedure

1) Turn the setting-enable (DATA SET) key to the DATA SET position.
2) In the top menu, touch the MANUAL button to call up the manual operation screen.
3) Touch the "Roving" button to call up the roving assist window.
4) Touch either one of the following buttons according to the roving loosening position.
   While the button is touched, the loosening operation works.

- Loosening roving between the front roller and flyer cap

  Draft forward inching button
  When this button is held down, only the draft part operates.
  (Delivery speed: Approx. 7 mm/s.)

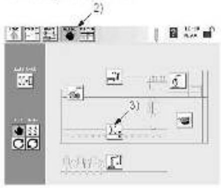
- Loosening roving between the presser and bobbin of roving

  Bobbin reverse inching button
  When this button is held down, bobbins rotate in the reverse direction from that at delivery.
  (Bobbin rotation speed: Approx. 5 rpm)

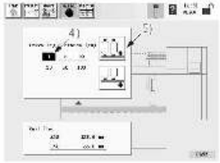
5) Visually check the roving tension and release the button when the roving becomes loose properly.

NOTE: Loosening roving more than necessary sometimes causes trouble at the restart time.
Be careful with the roving tension during the above operating procedure.

Manual operation screen



Manual bobbin rail operation window



Reference:

About the bobbin rail movement speed

- 10 mm from the start position:
  Low speed (approx. 2 mm/s)
- During movement:
  High speed (approx. 20 mm/s)
- 2 mm before the stop position:
  Low speed (approx. 2 mm/s)

[21] Manual Bobbin Rail Up/Down Function

Separately from the conventional bobbin rail-up and -down switches on the operation panel to be used in doffing, this manual bobbin rail up/down function is provided on the function panel for maintenance and adjustment.

The conventional switches move the bobbin rail to the preset position (winding start position, empty-bobbin loading position, or doffing position).

Unlike those switches, the manual bobbin rail up/down function allows the operator to select the bobbin rail movement distance and direction on the function panel, enabling flexible up/down movement.

(1) Operating procedure

NOTE: When roving operation is in progress, the following procedure is disabled.

NOTE: Before proceeding to the procedure, check the following.

- The abnormal up- and down-movement limits of the bobbin rail are adjusted.
- There are no obstacles in the bobbin rail travel direction.
- Workers and surroundings are safe.

NOTE: If any trouble occurs, bring the FL to an emergency stop with the emergency stop switch.

1) Turn the setting-enable (DATA SET) key to the DATA SET position.
2) In the top menu, touch the MANUAL button to call up the manual operation screen.
3) On the manual operation screen, touch the manual bobbin rail button to call up the manual bobbin rail operation window.
4) Touch the desired rail movement distance box.
   (Choices: 1, 5, 10, 20, 50, and 100 mm)
5) Touch either one of the following movement direction buttons. The bobbin rail moves to the specified direction by the distance selected in 4) above.
   - Moving up the bobbin rail
     [Touch the bobbin rail up-movement button.
   - Moving down the bobbin rail
     [Touch the bobbin rail down-movement button.

Tip: To move the bobbin rail 8 mm

This function provides a choice of six movement distances–1, 5, 10, 20, 50, and 100 mm. To move the bobbin rail 8 mm, therefore, move it by 5 mm, 1 mm, 1 mm, and 1 mm.

[22] Individual Motor Drive Function

The FL drives four motors--main, winding, lifting, and drafting motors. The individual motor drive function enables the operator to drive those individual motors each at an arbitrary speed.

Unlike the 4-shaft synchronous operation started by the Start switch, this function drives individual drive shafts separately at low speed (not available during roving operation) so that it supports maintenance and inspection jobs including the following.

- Checking individual drive shafts (normal or abnormal)
- Checking the timing belt tension adjustment
- Checking the main motor and pulley belt tension adjustment
- Greasing the draft part

(1) Operating procedure

NOTE: When roving operation is in progress, the following procedure is disabled.

NOTE: Confirm that workers and surroundings are safe.

NOTE: If any trouble occurs, bring the FL to an emergency stop with the emergency stop switch.

- **Driving the main motor (flyer shaft) at 200 rpm**

1) Turn the setting-enable (DATA SET) key to the DATA SET position.

2) In the top menu, touch the MANUAL button to call up the manual operation screen.

3) On the manual operation screen, touch the motor button to call up the "Individual Drive of Motor" window.

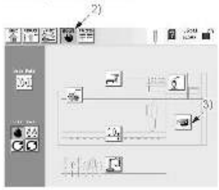
4) Enter the desired speed (200 rpm in this example) to the main motor M1 field.
M1: Main motor
M2: Winding motor
M3: Lifting motor
M4: Drafting motor

5) Touch ON in the target motor row (main motor M1 row in this example).
ON: Drive the motor
OFF: Do not drive the motor

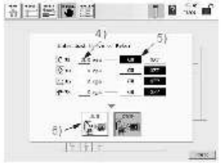
6) Touch the RUN button. The confirmation window appears.
Check for safety and touch Yes to start driving the motor.

NOTE: To cancel it, touch No.

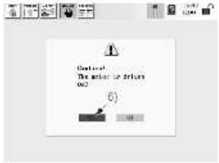
Manual operation screen



"Individual Drive of Motor" window
(Motor stopped)

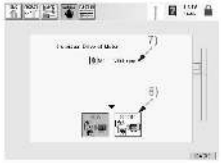


Confirmation window

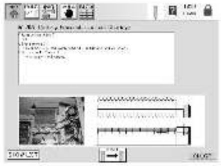


Caution!
The motor is driven
OK?

"Individual Drive of Motor" window
(Motor being driven)



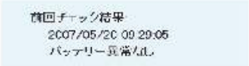
Battery power insufficient



7) Run the FL and check the battery check result.

- If the battery power is insufficient:
  The warning message "W-76A Battery Remainder Amount Shortage" appears.
  ⇒ Replace the backup battery connected to the control power board. (Refer to Section 7.1.5, [2].
- If the battery checking fails:
  The warning message "W-76B Battery Check Not Completed" appears.
  ⇒ Perform the battery check operating procedure again.
- If the battery power is normal:
  Without any warning message displayed, the CPU starts up.
  The check result "Battery Normal" that the FL logs is displayed in the battery check result window.

Log of the last check result



前回チェック結果
2007/05/20 09:29:05
バッテリー異常なし

(2) Log of the last battery check result
The FL keeps a log of the last check result and displays it in the battery check result window. The log contains the following.

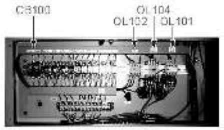
- Check date
- Check result (e.g., Battery Normal, Battery Remainder Amount Shortage)

NOTE: The log can be used as a guide for the next battery check.

7.1.4 Abnormal Operations

[1] Action Upon Thermal Relay Tripping

Each of the following motors (for cleaning device) is provided with a thermal relay circuit and its protector. If any of those thermal relay circuits and their protectors trips, all operations of the cleaning device and FL are stopped and the alarm message "E-14 Cleaning Device Thermal Tripped" appears on the function panel.



Inside the C-BOX

Motor	Thermal relay symbol
CWC motor (M100)	CB100
Blower motor (M101)	OL101
Blow cleaner motor (M102)	OL102
BS suction motor (M104)	OL104

ACTION:

If any of the thermal relay circuits and their protectors trips, turn the main circuit breaker (CB1) OFF and then check the following items.

DON'T TURN THE SWITCH ON

⚠ WARNING

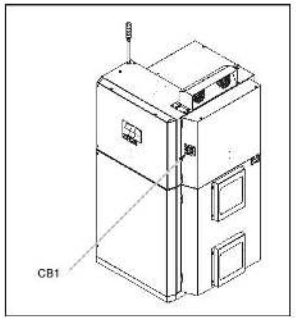
Be sure to observe the rules given in Section S.1, Subsection S.1.4, "Rules for Operating or Checking the Electrical Devices."

(1) Search for the tripped one among the thermal relays in the control box C-BOX.

(2) Check the motor corresponding to the tripped thermal relay for interphase short circuit or ground fault.

(3) If no abnormality is found, check whether the bearing of the motor unit is defective and the load to the motor is abnormal.

After taking any recovery action, reset the thermal relay and run the FL to observe the operating state.



[2] Action Upon Circuit Breaker Tripping

The FL has four circuit breakers to protect the circuits listed below.

Symbol	Location	Voltage	Breaking current	Protect the following
CB1	Control box (B-BOX)	AC line voltage	—	Main power supply open/close circuit
CB2	Control box (A-BOX)		—	Cleaning device circuit
CB3		200 VAC	2A	Fan motor circuit
CB4	Control box (C-BOX)	100 VAC	5A	100 VAC circuit
CB100	Control box (C-BOX)	100 VAC	5A	CWC motor

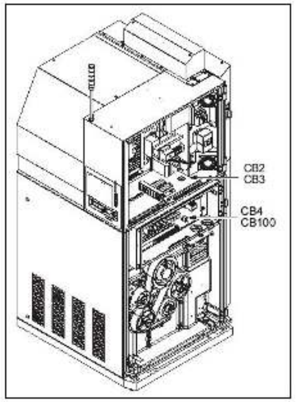
DON'T TURN THE SWITCH ON

⚠ WARNING

> Be sure to observe the rules given in Section S.1, Subsection S.1.4, "Rules for Operating or Checking the Electrical Devices."
>
> Even after turning the inverter power off, take extra care since the smoothing capacitors will remain charged for a while.

(1) If CB1 is tripped
Check the electrical parts and wiring following the CB1 on the circuitry.

1) Magnet switch (MS1)
2) AC/DC converter (CONV1)
3) Main inverter (INV1)
4) Servo amplifiers (AMP2, 3, 4)



(2) If CB2 is tripped
Check the following cleaning device motors for any interphase short circuits or ground faults.

1) M101 (Blower motor)*
2) M102 (Blow cleaner motor)*
3) M104 (BS suction motor)*

*Option

(3) If CB3 is tripped
Check the following cooling fan motors for any interphase short circuits or ground faults.

1) M5 (Gear head cooling fan, upper)
2) M6 (Gear head cooling fan, lower)
3) M12 (Control box internal circulation fan, upper)
4) M13 (Control box internal circulation fan, lower)
5) M14 (Servo amplifier heat sink cooling fan)
6) M15 (Inverter heat sink cooling fan)

(4) If CB4 is tripped
Check the following electrical devices and their wiring on the 100 VAC circuitry.

1) Function panel power supply (DISP1)
2) Magnet switch (MS1) coil circuit

(5) If CB5 is tripped
Check the CWC motor (M100) for any interphase short circuit, ground fault, or overload.

[3] Action Upon Activation of Fan Motor Thermal Switch

OUTLINE:

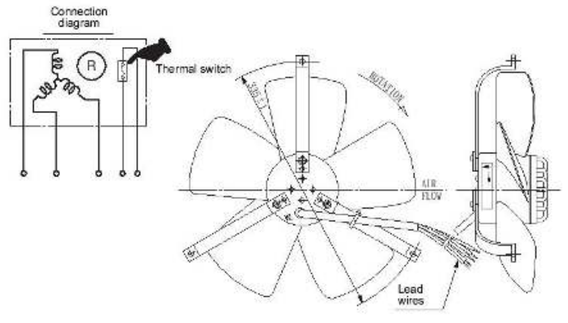
1) Cooling fan motors M5 and M6 in the GE are equipped with a thermal switch for overload protection.

Name	Symbol	Input voltage	Output	Function	Thermal switch symbol
Gear head cooling fan (upper)	M5	200 VAC	44W	Cooling the inside the gear head in the GE	THS5
Gear head cooling fan (lower)	M6		44W		THS6

FUNCTION:

1) If a thermal switch is activated, all operations of the cooling fans and FL are stopped and the alarm message appears on the function panel. According to the alarm message, identify the abnormal fan motor and investigate and repair it.

2) The thermal switch is automatically reset when the motor coil temperature returns to the normal level.



[4] Protective Operation at the Time of the Power Failure

The FL runs the flyer, winding, lifting, and drafting mechanisms with separate four motors in the 4-shaft synchronous drive. For the time of the power failure, it supports a synchronous stop of those motors for preventing roving breaks.

When a power failure (including a momentary power failure for 6 ms or more) occurs, the FL immediately decelerates the main motor to produce regenerative energy to be used for backing up other three motors and decelerate all four motors to a synchronous stop.

Error message "E-64 Stop due to power failure" indicates that the FL came to a stop due to a power failure.

If a power failure occurs frequency, there is a problem with the factory power system, e.g., insufficient power capacity. Conduct prompt investigation and take an appropriate action.

If a synchronous stop operation fails (e.g., roving breaks on all spindles, loose roving), the following causes can be considered.

(1) Inverter INV1 abnormal

(2) Backup capacitors C10, C11 (C12, C13) discharged

NOTE: The battery capacity can be checked with the battery check function described in Section 7.1.3, [23].

7.1.5 Maintenance

⚠ WARNING

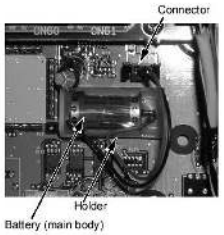
Be sure to observe the rules given in Section S.1, Subsection S.1.4, "Rules for Operating or Checking the Electrical Devices."

DON'T TURN THE SWITCH ON

⚠ WARNING

- The authorized persons only should be allowed to carry out maintenance inspection and replace parts.
- Before starting inspection jobs, turn off the main circuit breaker and wait at least 20 minutes. Further, check that the inverter power lamp is unlit and the DC ink bus voltage between the P (+) and N (-) terminals is lower than 45 VDC.
  An electric shock could occur.
- Take off watches, bracelets, and any other metal objects. Use insulated tools.
  An electrical shock or bodily injury could result.

[1] Main Control Board's Battery Replacement



On the main control board is a lithium battery that backs up data when the power is OFF or a power failure occurs.
The battery should be replaced before the service life is expired.

[1.1] Battery ratings

Model : ER3WK (thionyl chloride - lithium battery)
Nominal voltage : 3.6 V
Typical battery capacity : 910 mAh
Typical discharge current : 40 µA

[1.2] Service life

Approx. 5 years provided that the battery is used under appropriate conditions.
(Replacement at 3-year intervals is recommended.)

[1.3] Replacement procedure

(1) Turn the power off.
(2) Disconnect the battery connector.
(3) Pull the battery unit out of the holder.
(4) Push a new battery unit into the holder.
(5) Connect the new battery connector.

NOTE: Leaving the main control board with no battery loaded for a long time loses data held on the board. Connect a new battery within 5 minutes after the disconnection of the old one.

It is recommended that you make a backup copy of the configuration data in a memory card just in case.
If held in storage for a long time, a battery will be discharged naturally. It is recommended that a new battery be ordered just when the replacement day is approaching.

[2] Main Control Board Replacement

When replacing the CPU board (one component of the main control board), it is necessary to install control programs and select the FL specifications, referring to "[9] Installation of Main Control Program" in this section.

[3] Main Inverter Replacement

When replacing the main inverter as a complete unit, configure the DIP switches on the option board in a new inverter unit and check the parameter values. (Refer to Section 7.1.2, [6].)

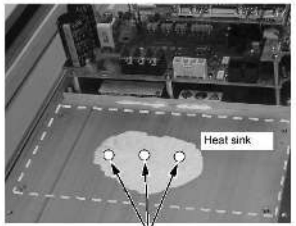
[4] Servo Amplifier Replacement

[4.1] Selecting the type of a new servo amplifier and configuring the DIP switch.

Selecting the type of a new servo amplifier and configuring the DIP switch. (Refer to Section 7.1.2, [7.2], (2).)

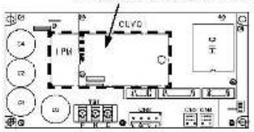
[4.2] Applying oil compound for heat radiation

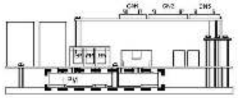
When replacing the servo amplifier, it is necessary to apply oil compound for heat radiation to the joint surface between the aluminum base of a new servo amplifier and the heat sink in order to maintain the servo amplifier heat radiation efficiency.
Running the servo amplifier without oil compound application rises the amplifier temperature, resulting in a failure.



Oil compound application points

Apply oil compound to three points on the heat sink under this section.





■ Application procedure

(1) Remove the old amplifier to be replaced. Leave the old oil compound on the heat sink as is and add new oil compound to the old one.

(2) Apply oil compound to the heat sink where the servo amplifier IPM exists.
Since the oil compound is naturally extended by contact with the amplifier, a small amount should be applied to each of the three points under the IGBT as shown at left.

(3) Put a new servo amplifier on the heat sink and secure it with bolts.

■ Recommended oil compound

Type :KS-609
Product name :Oil Compound (for heat radiation)
Manufacturer :Shin-Etsu Chemical
Thermal conductivity :0.75 W/m•K

Type :YG6111
Product name :Oil compound (for heat radiation)
Manufacturer :GE Toshiba Silicone
Thermal conductivity :0.84 W/m•K

NOTE: Other manufacturers' oil compounds can be used provided that they are prepared for heat radiation of electrical devices and have a thermal conductivity of 0.75 W/m•K or more.

[5] Cooling Fan Life and Replacement

Cooling fans are provided near individual electrical devices.

Symbol	Used to:
M5, M6	Cool down the inside of the gear end head.
M12, M13	Circulate the air inside the control box.
M14, M15	Cool down the servo amplifiers and inverter heat fins.

The service life of cooling fan motors' bearings is 2 to 3 years. It is recommended to replace those fans according to this period as a guide.

[6] Electrolytic Capacitor Life and Replacement

[6.1] Smoothing capacitors on the DC link bus in the main inverter (INV1)

It is recommended to replace the smoothing capacitors (backup capacitors C10, C11 (C12, C13)) on the DC link bus with spare parts every 5 years because of their life.
Replacement with spare capacitors stored for 3 years or more needs preparatory aging. However, it is difficult at the user site, so it is recommended to order new capacitors just when the replacement day is approaching.

[6.2] Electrolytic capacitors on the control board in the main inverter (INV1)

It is recommended to replace the electrolytic capacitors on the control board every 5 years because of their life.
Note that the replacement is difficult at the user site, so it is recommended to replace the control board or inverter with spare ones and send it to repair.

[7] Updating of Main Control Program

NOTE: Before proceeding to the updating procedure, be sure to stop the FL.

[7.1] Updating procedure
(for the CPU board in use)

(1) Back up all data being in use in a memory card.

(2) Turn bit 2 of DIP switch SW1 on the CPU board to the ON position.

(3) Turn the setting-enable (DATA SET) key to the DATA SET position and then insert the program memory card containing the main control program to update.

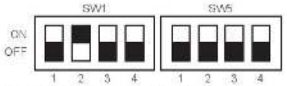

SW1
SW5
ON
OFF
1
2
3
4
1
2
3
4

Figure 1. DIP Switches on the CPU Board

(4) Touch the FUNCTION button in the top menu and select the MAKER button in the tool bar to call up the manufacturer setting screen (Figure 2).

(5) Touch the PROGRAM button to call up the program-related menu (Figure 3).

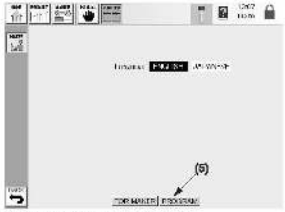

ENGLISH
(5)
FOR MAKER
PROGRAM

Figure 2. Manufacturer Setting Screen

(6) Touch "Write a program to the machine."

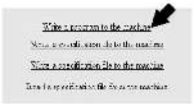
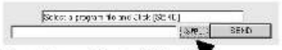

Write a program to the machine
Write a specification file to the machine

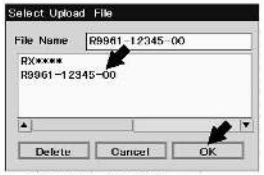
Figure 3. Program-related Menu

(7) Wait for the program selection window to appear, then touch the BROWSE button.



Select a program file and click [SEND]

Figure 4. Program Selection Window (1)



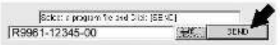
Select Upload File

File Name R9961-12345-00

RX****
R9961-12345-00

Figure 5. "Select Upload File" Dialog

(8) Wait for the "Select Upload File" dialog to appear, select the program to be uploaded, and then touch the OK button.



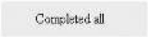
Select a program file and Click [SEND]

R9961-12345-00

Figure 6. Program Selection Window (2)

(9) Check that the program name in the box on the left side of the BROWSE and SEND buttons is the one you selected, then touch the SEND button.

(10) Wait for the program to be uploaded. The uploading operation takes approx. 2 minutes.



Completed all

(11) Wait for the message "Completed all" to appear, then turn the power OFF.

NOTE: During uploading (while writing is in progress with the percentage displayed), never turn the power OFF or run the FL. If the power is turned OFF, the program no longer operates normally.

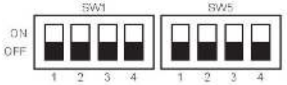


Figure 7. Final DIP Switch State (all bits OFF)

(12) Turn bit 2 of DIP switch SW1 back to the OFF position, then turn the power ON.

NOTE: Updating the program automatically clears the RAM.

(13) Load all data backup made in step (1) from the data memory card.

(14) Upon completion of uploading, turn the power OFF and ON.

NOTE: After making sure that the current bobbin rail position is correct, run the FL.

[8] Installation of Main Control Program

[8.1] Installation procedure (for a new CPU board with no program loaded)

NOTE: If the CPU board is replaced, the FL cannot run without loading the main control program to a new CPU board since a new one holds no program. Install the main control program using the master program card according to the procedure given below.

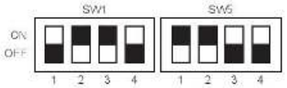


Figure 1. DIP Switches on the CPU Board

(1) Turn bits 2 and 3 of DIP switch SW1 and bits 1 and 2 of DIP switch SW5 on the CPU board to the ON position.

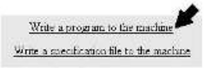
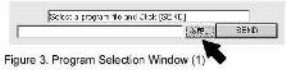

Write a program to the machine
Write a specification file to the machine

Figure 2. Program Transfer Screen

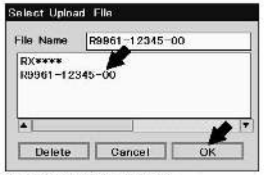
(2) Turn the power ON and insert the master program card.
Wait for the program transfer menu to appear, then touch "Write a program to the machine."



Select a program file and Click [SEND]

Figure 3. Program Selection Window (1)

(3) Wait for the program selection window to appear, then touch the BROWSE button.

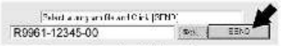


File Name R9961-12345-00

RX****
R9961-12345-00

Figure 4. "Select Upload File" Dialog

(4) Wait for the "Select Upload File" dialog to appear, select the program to be installed, and then touch the OK button.



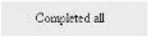
Select a program file and Click [SEND]

R9961-12345-00

Figure 5. Program Selection Window (2)

(5) Check that the program name in the box on the left side of the BROWSE and SEND buttons is the one you selected, then touch the SEND button.

(6) Wait for the program to be installed. The installation operation takes approx. 2 minutes.



Completed all

(7) Wait for the message "Completed all" to appear, then turn the power OFF.

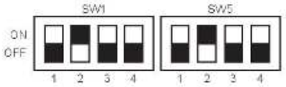


Figure 6. DIP Switches on the CPU Board

(8) Turn bits of DIP switches SW1 and SW5 back to the OFF position except bits 2 on both switches, then turn the power ON.

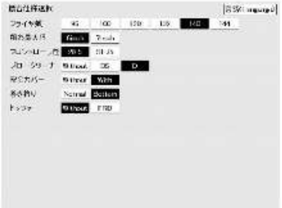


Figure 7. Machine Specifications Selection Screen

(9) Wait for the machine specifications selection screen to appear.
Turn the setting-enable (DATA SET) key to the DATA SET position.
Select your machine specifications correctly, then touch the SET button.

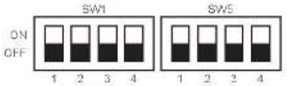


Figure 8. Final DIP Switch State (all bits OFF)

(10) Upon completion of machine specifications setting, turn the power OFF, turn all bits of DIP switches to the OFF position, and then turn the power ON.

[9] Machine Specifications Selection

IMPORTANT

When the FL is first installed or the built-in boards are replaced, it is required to enter the actual machine specifications. Incorrect setting that does not match the actual FL specifications cannot run the FL correctly.

(1) Turn bits 2 of DIP switches SW1 and SW5 on the CPU board to the ON position.

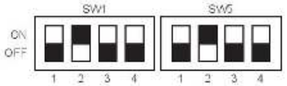


Figure 1. DIP Switches on the CPU Board

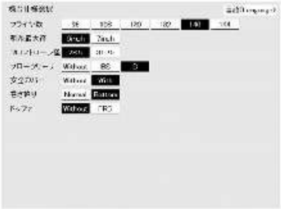


Figure 2. Machine Specifications Selection Screen

(2) Turn the power ON. The machine specifications selection screen appears.
Select the following items on the screen.

1) Number of flyers:
Select the number of flyers on the FL.
Choice: [96], [108], [120], [132], [140], [144]

2) Package diameter:
Choice: [6-inch], [7-inch]

3) Front roller diameter:
Choice: [28.5], [31.75]

4) Blow cleaner:
Choice: [Without]... without blow cleaner
[BS].......... with BS blow cleaner
[D]............ with D blow cleaner

5) Flyer safety cover detection sensor:
Choice: [Without]... without sensor
[With]........ with sensor

6) Bottom bunch winding:
Choice: [Normal] ... without winding function
[Bottom] ... with winding function

7) Doffer (FRD):
Choice: [Without]... without doffer
[With]........ with doffer

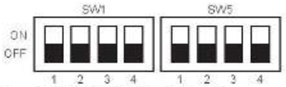


Figure 3. Final DIP Switch State (all bits OFF)

(3) Turn the setting-enable (DATA SET) key to the DATA SET position.

(4) Select the machine specifications correctly, then touch the SET button displayed in the bottom right corner of the screen.

(5) On the confirmation screen, touch YES to write the settings into the memory.

Tip: The settings made on the screen are written into the flash memory on the CPU board, so clearing RAM following program updating does not clear those settings.

(6) Upon completion of machine specifications settings, turn the power OFF, turn all bits of DIP switches to the OFF position, and then turn the power ON.

Tip: The current machine specifications settings can be referred to not only on the machine specifications selection screen (Figure 2) but also on the Help screen. To call up the Help screen, touch the ? button at the right side in the top menu.
After changing the settings, make sure that all settings are correct.

[10] Clearing the RAM

Clearing the RAM initializes all of the setting data and control program stored on the CPU board. Updating the main control program automatically clears the RAM.
This section describes the manual RAM clearing procedure.
Clearing the RAM requires setting up the bobbin rail zero point and tension sensor origin point.

[10.1] RAM clearing procedure

(1) Turn bit 4 of DIP switch SW5 on the CPU board to the ON position.
(This cancels the RAM clearing protection.)

(2) Press the emergency stop button to lock the FL.

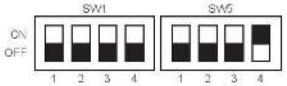


Figure 1. DIP Switches on the CPU Board

(3) While holding down the bobbin rail-down switch, turn the power ON and keep the switch held down until the main screen appears.
On the screen the "RAM cleared" appears.

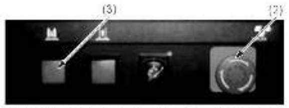


Figure 2. Emergency Stop Button and Bobbin Rail-down Switch

(4) Turn the power OFF and turn all bits of DIP switches on the CPU board to the OFF position.
(This enables the RAM clearing protection.)

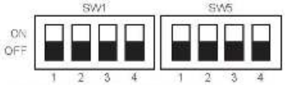


Figure 3. Final DIP Switch State (all bits OFF)

[10.2] Reentry procedure

After clearing the RAM, make all settings including the bobbin rail zero point and tension sensor origin point again with the following procedure.

(1) Turn the power ON.

(2) The main screen appears and the system starts up. Enter all settings.

(3) Set the bobbin rail zero point.

(4) Set the tension sensor origin point.

Tip: If all of the setting values and control data have been backed up in a memory card, using the card restores those data in steps (3) and (4).

7.1.6 Cleaning and Inspection at Periodic Maintenance

[1] General

Item	Maintenance	Interval
1. Cleaning (Clear fleece or fly with a vacuum cleaner from the sections listed in the right column.	Clear fleece or fly with a vacuum cleaner from the following: • Inside of the control boxes • Cooling fan cover of each motor	Every 3 months
	• Meshes at the vents of the cooling fans	Daily
	• Heat sinks on the inverters and servo amplifiers	Every 1.5 months
2. Inverters	Perform maintenance on the inverters (see the next page), referring to the Inverter Instruction Manual, "Maintenance and Inspection."	Daily and every 3 months
3. Rotation of fan motors	• Turn off the power and turn the fans by hand to check whether they rotate smoothly. • Check for abnormal noise when the fan motors are in rotation.	Every 6 months
4. Looseness of screws on terminals	• Visually check the power circuitry for no discolored section caused by heat generated due to looseness of screws on the terminal block. • Check with a screwdriver that the screws on the terminal pins are not loose.	Every year
5. Looseness of connectors	Check that the connectors are fully inserted. • Main control board	Every year

[2] Inverters and Servo Amplifiers

DON'T TURN THE SWITCH ON

⚠ WARNING

- The authorized persons only should be allowed to carry out maintenance inspection and replace parts.
- Before starting inspection jobs, turn off the main circuit breaker and wait at least 20 minutes. Further, check that the inverter power lamp is unlit and the DC ink bus voltage between the P (+) and N (-) terminals is lower than 45 VDC.
  An electric shock could occur.
- Take off watches, bracelets, and any other metal objects. Use insulated tools.
  An electrical shock or bodily injury could result.

NOTE: For details, refer to the Inverter Instruction Manual that comes with the FL.

Item	Description	Interval
1 Power supply and load	Check the following. • Motor speed (rpm) • Power voltage • Output frequency, output voltage, and output current	Daily
2 Abnormal noise	Check the inverters, servo amplifiers, and motors for abnormal noise.	
3 Temperature and humidity	• Temperature rise in the inverters and servo amplifiers • Temperature rise in the motor • No dew condensation. Relative humidity at 90% or less.	
4 Oil mist	Oil mist gets into the control boxes? Oil mist gets into the inverter unit?	
5 Heat sinks	Check that heat sinks are not clogged with fly or dust. Blow compressed air for cleaning.	Every 1.5 months
6 Terminals and connectors	Is there any loosened terminal or connector?	Every 3 months
7 Vent hole	Check any dust or dirt accumulation.	
8 Printed circuit boards and main circuit	Vacuum fly and dust away.	

7.1.7 Interface Signals for External Blow Cleaner (Prepared by the customer)

If the customer prepares an external blow cleaner without purchasing the built-in blow cleaner, make the wiring as shown below for interlocking the cleaner with the FL.

(1) Power supply to the blow cleaner

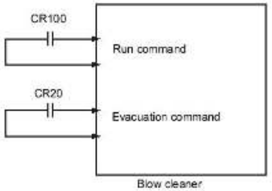
For motors with a capacity of 1.5 kW or below, the power cable should be connected to the secondary side (R2, S2, T2, and E) of circuit breaker CB2 in the FL control box.

NOTE: Provide a discrete control board for the blow cleaner.
Never feed from controlled source of FL200 (AC200V, AC100V, DC24V, DC5V). Such feeding may cause a glitch in the FL or damaged components.

(2) Interface signals between the blow cleaner and FL

1) For automatic operation of the blow cleaner by interlocking with the FL, use the "a" contact (opened when OFF) of relay CR100 for issuing a run command signal to the blow cleaner.

2) To evacuate the blow cleaner immediately before a full-bobbin stop, use the "a" contact of relay CR200 for issuing an evacuation command signal to the blow cleaner.



The delivery length to be applied when the blow cleaner should be evacuated can be specified from the function panel of the FL.

(3) Operation panel exclusively designed for the blow cleaner

The FL has no operation panel exclusively designed for the blow cleaner, so the customer should prepare it separately.

It is recommended to set up a control box having automatic, manual, and stop switches.

Section 8.1
Troubleshooting

8.1.1 Troubleshooting According to the Error Messages 8.1-2
[1] Classification of Error Messages 8.1-2
[2] List of Error Messages 8.1-3
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[4] Detailed Recovery Actions 8.1-14

8.1.2 Troubleshooting According to the Symptoms 8.1-23
[1] Failure to Run or Inch (None of the three motors can run) 8.1-23
[2] Motors can run but they are not synchronized with each other 8.1-24
[3] Independent bobbin rail movement failures 8.1-27
[4] Roving cutting failures at full-bobbin state 8.1-28
[5] False Stops 8.1-29
[6] Function Panel Screen-Related and Data Setting Failures 8.1-30
[7] Abnormal States during Power Failure 8.1-31
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8.1.3 Reference Materials 8.1-34
[1] Voltage Check List 8.1-34
[2] Spinning Condition Check Sheet 8.1-35

8.1 Troubleshooting

8.1.1

DON'T TURN THE SWITCH ON

⚠ CAUTION

During troubleshooting, be sure to observe the precautions given in Section S.1, Subsection S.1.2, "Rules for Safe Operation," Subsection S.1.3, "Rules for Maintenance," and Subsection S.1.4, "Rules for Operating or Checking the Electrical Devices."

The capacitor is charged even after main breaker is off, because an inverter is in use. Therefore, wait at least 10 minutes for operation involving direct touch with the wiring.

[1] Classification of Error Messages

The error messages that will be shown on the operation panel of the FL are divided into the classes given in the table below.
If a message appears, check the contents of the message and then take the necessary actions.

Class	Contents	Resetting for operation
E-✱✱	• Trouble in operation causing frame stop • Trouble in stopped state not related to the operator	Resetting after corrective action needed
W-✱✱	• Trouble in operation not causing frame stop • Trouble in stopped state related to the operator	Resetting after corrective action needed
INV1-✱✱	• Trouble related to main motor inverter	Resetting after corrective action needed
AMP2-✱✱	• Trouble related to GE side middle roller driving servomotor/amplifier	Resetting after corrective action needed
AMP3-✱✱	• Trouble related to GE side back roller driving servomotor/amplifier	Resetting after corrective action needed
AMP4-✱✱	• Trouble related to ring rail driving servomotor/ amplifier	Resetting after corrective action needed
Text only (no symbol)	• Message upon operating panel operation or setting • Frame status message	No action needed. (The message disappears automatically.)

NOTE: NOTE: Trouble messages (E-, W-, INV-, AMP-) will be registered in the trouble log automatically. The history of troubles that have occurred can be accessed via the message display screen of the maintenance mode. (Access method: click the [MAINTE] icon and then the [MESSAGE] icon).

NOTE: NOTE: For some of the E- and W- trouble messages, the corresponding Explanation and the necessary Action to be taken can be accessed on the FL
machine. (Check the Help display screen's "Trouble List").

NOTE: The trouble messages are classified according to the list below:

FL... An overall error of the whole machine

SM... Stop Motion error

SE... Setting error

FRD... An error of the FRD specifications only

INV... Inverter error

AMP... Servo Amplifier error

[2] List of Error Messages

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
E-01	Emergency PB or Door Open	FL	The emergency stop button has been pushed or the GE door is open.	1 If the emergency stop button has been pressed, remove the cause of the stop and then release the lock. 2 If the door is open, close it completely. 3 Adjust the door switch.	E-01
E-03	Flyer Cover Open	FL	The flyer cover is open	1 Close the flyer safety cover. 2 Inspect the safety cover sensors (PHR9, PHL9).	E-03
E-10	Fan (M5) Temperature	FL	The temperature switch (THS5) of the (upper) gear head fan activated.	Inspect the gear head fan (upper) M5, and remove the source of the abnormality.	E-10
E-11	Fan (M6) Temperature	FL	The temperature switch (THS6) of the (lower) gear head fan activated.	Inspect the gear head fan (lower) M6, and remove the source of the abnormality.	E-11
E-14	Cleaning Device Thermal Tripped	FL	One of the thermal relays of the cleaning devices activated. (CB100, OL101, 102, or 104)	Remove whatever caused the cleaning device thermal relay (CB100, OL101, 102, or 104) activation, and reset the thermal relay.	E-14
E-15	Oil Pressure is Lower	FL	An oil circulation abnormality has occurred. (During operation the pressure switch (PS1) detected no pressure for 10 seconds or more.)	Inspect the oil circulation system and remove the source of the abnormality. (oil amount, clogged filters, oil pump) This error cannot be cleared unless the power is turned OFF and then back ON.	E-15
E-16	Oil Pressure SW is Troubled	FL	The oil pressure sensor has malfunctioned. (While the FL200 was stopped, the pressure switch (PS1) detected pressure for 10 seconds or more.)	1 Inspect oil pressure switch (PS1) for any malfunctions. 2 Inspect the input circuit of pressure switch (PS1) for any abnormalities. (Terminals E12 to 104 should be conducting while the FL200 is stopped.)	E-16
E-17A	Flyer Grease Pressure Remain Lo	FL	While grease was being supplied to the flyer gears, the pressure sensor (PS2) did not turn ON.	Inspect the flyer grease circulation system and remove the source of the abnormality. (clogged filters, grease pump)	E-17A
E-17B	Bobbin Grease Pressure Remain Lo	FL	While grease was being supplied to the bobbin gears, the pressure sensor (PS3) did not turn ON.	Inspect the bobbin grease circulation system and remove the source of the abnormality. (clogged filters, grease pump)	E-17B
E-18A	Flyer Grease Pressure Remain High	FL	Before grease was supplied to the flyer gears, the pressure sensor (PS2) turned ON.	1 Inspect the grease pressure switch (PS2) for any malfunctions. 2 Inspect the input circuit of grease pressure switch (PS2) for any abnormalities. (Terminals E12 to 117 should not be conducting while the FL200 is stopped.)	E-18A
E-18B	Bobbin Grease Pressure Remain High	FL	Before grease was supplied to the bobbin gears, the pressure sensor (PS3) turned ON.	1 Inspect the grease pressure switch (PS3) for any malfunctions. 2 Inspect the input circuit of grease pressure switch (PS3) for any abnormalities. (Terminals E12 to 119 should not be conducting while the FL200 is stopped.)	
E-26	Flyer Position (PRS1) is Abnormal	FL	An abnormality has occurred in optimal flyer position switch (PRS1).	Inspect the flyer optimum position switch (PRS1) to confirm if its clearance adjustment is appropriate.	
E-27	Bobbin Rail Over Run	FL	The bobbin rail position has exceeded its upper or lower limit	Adjust the installation positions of the bobbin rail upper limit switch (LSUP) and lower limit switch (LSDW).	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
E-28	Bobbin Rail Position Changed	FL	The actual position of the bobbin rail is different from the position stored in the memory. (The rail was moved while the power was off, etc.)	1 Inspect the lifting encoders (PG0, PG3) for any abnormalities. 2 Inspect the connectors listed below for faulty attachment. (PCB4: CN3, CN4, I/O1: CN16, CN26, I/O2: CN56, AMP3: CN2) 3 Lower the bobbin rail to the over-down position and reset the alarm. 4 If the alarm cannot be cleared in 3), set the origin of the bobbin rail again.	
E-29	Lifting Reverse is Abnormal	FL	The target lifting reverse position has been exceeded by 5 mm or more.	1 Inspect the lifting drive system for any abnormalities. 2 Inspect lifting encoder (PG3) for any abnormalities. 3 Inspect the connectors listed below for faulty attachment. (PCB4: CN3, CN4, I/O1: CN16, CN26, AMP3: CN2) 4 If the alarm cannot be cleared, then replace servo amplifier AMP3, servo motor M3, the I/O1 board, or the PCB4 board.	
E-30	Tension Sensor Head 1 is Abnormal	FL	Tension sensor head 1 detected a roving position value of "origin point + 10bit or more" for more than 3 seconds. Or, no roving was detected for 10 seconds.	1 Confirm the spinning condition of the roving. 2 Confirm that the origin point position of the tension sensor has not changed. 3 Carry out the tension origin point position setting procedure.	
E-31	Tension Sensor Head 2 is Abnormal	FL	Tension sensor head 2 detected a roving position value of "origin point + 10bit or more" for more than 3 seconds. Or, no roving was detected for 10 seconds.	1 Confirm the spinning condition of the roving. 2 Confirm that the origin point position of the tension sensor has not changed. 3 Carry out the tension origin point position setting procedure.	
E-32	Tension Sensor Head 3 is Abnormal	FL	Tension sensor head 3 detected a roving position value of "origin point + 10bit or more" for more than 3 seconds. Or, no roving was detected for 10 seconds.	1 Confirm the spinning condition of the roving. 2 Confirm that the origin point position of the tension sensor has not changed. 3 Carry out the tension origin point position setting procedure.	
E-33	Over Full Bobbin Length	FL	The package diameter or the lift length has exceeded the preset range. (The FL200 will automatically stop within 2 layers)	Stop the FL200 and after doffing, make the full bobbin length setting smaller.	
E-34	Common Converter (CONV1) is abnormal.	FL	The common converter (CONV1) temperature switch has activated. (Overload of the diode module)	1 Inspect the common converter (CONV1) for any abnormalities. 2 Confirm if there is any problem with the cooling of the common converter (CONV1). (Heat sink is clogged with fly and fleece, etc.)	
E-35	MS10 Defective Operation	FL	A movement fault of the magnet switch (MS10) within the common converter (CONV1).	1 Inspect the magnet switch (MS10) within the common converter (CONV1) for any abnormalities. 2 Replace the magnet switch (MS10) within the common converter (CONV1).	
E-36	Flyer Driving System is Abnormal	FL	The pulse input value from the flyer encoder (PG1) was higher than the regulation value during one flyer rotation.	1 Inspect the flyer drive system for any abnormalities. 2 Confirm the adjustment of the optimal flyer position switch (PRS1).	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
W-37	Blow Cleaner Trouble	FL	The blow cleaner did not return to its evacuation position within the regulation time limit.	Inspect the running state of the blow cleaner for any abnormalities.	
W-44	Full Package Diameter is too Large	SE	Under the current settings the full bobbin diameter is too large.	Change the settings: *Decrease the full bobbin roving length. *Increase the lift length *Increase the shoulder angle	
W-45	Bobbin Length is too Large	SE	The bobbin length setting is wrong.	Input the data again so that the bobbin length will be kept within the range. [Bobbin length + doffing position < 494 mm]	
W-46	Winding Margin is too Large	SE	The winding margin setting is wrong.	Input the data again so that the winding margin will be kept within the range. [Winding margin < winding start position]	
W-47	Bobbin Shape is Wrong	SE	The bobbin shape setting is wrong.	Input the data again so that the bobbin shape will be kept within the range. [Lift length < (bobbin length - winding margin - 10mm)]	
W-48	Stop Position is Wrong	SE	The full bobbin stop position setting is wrong.	Input the data again so that the full bobbin stop position will be kept within the range. [Winding margin + 50/tan (shoulder angle) < Stop position < Winding margin + Lift length/2]	
W-49	Flyer Rev. is Wrong	SE	The set number of flyer revolutions is inappropriate.	Input the data again so that the number of flyer revolutions will be kept within the range.	
W-50	Sliver Exchange Pattern is Wrong	SE	The sliver exchange pattern setting is wrong.	Input the data again so that the sliver exchange pattern will be kept within the range. [Z1 + Z2 + Z3 + Z4 +Z5 < 50]	
W-51	Sliver Exchange Counter is Wrong	SE	The sliver exchange counter setting is wrong.	Input the data again so that the sliver exchange counter will be kept within the range. [Z1 + Z2 + Z3 + Z4 +Z5 > counter value]	
W-52B	Over Maximum Winding Motor Speed	SE	Under the current setting, the speed of the winding motor exceeds the limitation.	1 Set the flyer rotation speed lower. 2 Confirm the set number of twists.	
W-52C	Over Maximum Lifting Motor Speed	SE	Under the current setting, the speed of the lifting motor exceeds the limitation.	1 Set the flyer rotation speed lower. 2 Confirm the set number of layers.	
W-52D	D Over Maximum Drafting Motor Speed	SE	Under the current setting, the speed of the drafting motor exceeds the limitation.	1 Set the flyer rotation speed lower. 2 Confirm the set number of twists.	
W-56	Lift Length Setting is Abnormal	SE	The setting of the full bobbin roving length or lift length is wrong.	Change the settings: *Decrease the full bobbin roving length. *Increase the lift length *Increase the shoulder angle	
W-57	Bobbin Rail Zero Point is not Set	FL	The origin point of the bobbin rail is not set.	Carry out the bobbin rail origin point setting procedure.	
W-58	Tension Zero Point is not Set	FL	The origin point of the tension sensor is not set.	Carry out the tension origin point setting procedure.	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
W-59	Setting abnormality (value for the FRD removal position > value for the FRD insertion position)	SE (FRD)	The settings for the FRD removal and insertion positions are wrong.	Values need to be Re-Entered so that they are within the set range. [Value for the FRD removal position ≤ value for the FRD insertion position]	
E-61	Sliver Breakage Sliver	SM	The sliver has broken.	Piece the broken sliver together or take some other appropriate action and then press the Stop button to clear the error message.	
E-62	Roving Breakage	SM	The roving has broken.	Piece the broken roving together or take some other appropriate action and then press the Stop button to clear the error message.	
E-63	Roving Breakage at Middle	SM	The roving on the trunk of the bobbins has broken.	Piece the broken roving together or take some other appropriate action and then press the Stop button to clear the error message.	
E-64	Power failure	FL	*No power is being supplied. *Power supply voltage is falling. *Open-phase has occurred at the input power supply. *A power failure occurred for 6 ms or more.	Turn OFF the main circuit breaker. When the power supply is normal and generates properly: 1 Confirm whether there are any broken wires or poor contacts. 2 Replace the I/O board, CPU board, and inverter (INV1).	
E-65	Empty Bobbin Insert Failure	FL	The bobbin is not properly inserted into the bobbin wheel. (Detected at the start of transfer from the empty bobbin insert position to the start winding position)	1 Insert the tilted empty bobbins into the bobbin wheel properly. 2 If the error occurs frequently with a particular spindle: - Adjust the fork position. - Confirm the projection of the fork magnet. - Confirm the fitting of the bobbin wheel and the cap. 3 If the error occurs with multiple spindles: - Confirm the carrier stop position.	Only when specifications include FRD
W-65	Empty Bobbin Insert Failure	FL	Empty-bobbins have been loaded at the doffing position.	Remove all bobbins loaded on the bobbin rail and press the Bobbin Rail-up switch again.	
W-66	Sliver Cans Change	FL	The FL200 automatically stopped since it was time to replace the sliver cans.	Replace the necessary sliver cans, reset the alarm, and then restart the FL200.	
W-67	During Grease Action	FL	You attempted to run the FL200 during the grease lubrication process.	Wait until the grease lubrication procedure is complete and then run the FL200.	
W-68	Stop PB Input	FL	You pressed the Inching button, Start button or bobbin rail up/down button when the Stop button was being held down.	1 Confirm if the Stop button is being pressed. 2 Inspect the input circuit of the Stop button. (CR105 relay should be ON.)	
W-69	During Doffing	FL	During doffing, the Start button or Inching button were pressed.	1 Wait for the completion of doffing, and then start the FL200. 2 If the bobbin rail has not completely reached the winding start position, press the Bobbin Rail-up switch again.	
W-73	Resistor R1 Overload	FL	The FL200 is stopped frequently, and the temperature switch of the resistor that absorbs regenerative energy was activated.	1 Reduce the stop frequency of the FL200. 2 Reduce the set value of the DEC1. (makes the deceleration more gradual)	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
W-74	Automatic Descent is Canceled for a Small Package	FL	The package diameter was less than 60 mm so the automatic lowering was cancelled for safety reasons.	Cut the roving by hand. After widening the space between the pressers and bobbins, lower the bobbin rail down to the doffing position.	
W-75	Roving Number Count is Abnormal	FL	The roving package diameter has increased abnormally compared to the past three doffings. (There is a possibility of a roving number count change.)	1 Confirm that there is no problem the roving number count and the sliver. 2 Confirm that there is no problem with the sliver supply.	
E-80	FRD stopping	FRD	The transfer authorization signal from the FRD is OFF.	1 If the carrier is on the FL side rather than at the C3 stop position, then reverse the carrier and transfer it beyond the C3 stop position. 2 If the carrier is after the stop position C3, stop automatic operation if the FRD is in automatic operation. 3 If the cause was something other than the above, check the communication line.	Only when specifications include FRD
E-81	Bobbin rail transfer disabled	FRD	The FRD is prohibiting bobbin rail transfer.	1 Transfer the carrier to between C0 and C3. 2 If trouble persists after the transfer, check the communication line.	
E-82	Doffing interrupted	FRD	The cause of the stoppage was generated on the FL200 side during doffing.	1 Correct the FRD fault. 2 If the FRD is not faulty, check the communication line.	
E-83	Abnormal FRD communication	FRD	Failed initial communication check with the FRD. Or, the command from the doffer was interrupted during operation.	Confirm any abnormalities such as breaks in the communication line, etc.	
E-84	Falling of FRD bobbin detected	FRD	The bobbin fell during bobbin delivery from the FRD to the FL200. (During travel from the over-down position to the empty bobbin insert position.) There is a fallen bobbin on the bobbin rail upon arrival at the winding start position.	1 Pick up the empty bobbin and insert it into the FL bobbin wheel. **NOTE:** Check the empty bobbin insert position on the wheel for any dirtiness, surface damage, or deformation. 2 If the trouble occurs frequently with a particular spindle: 1 Adjust the fork position. (machine width, longitudinal, and height directions) 2 Check the fork for any bending. 3 Confirm the projection of the fork magnet. 4 Confirm the fitting of the FL bobbin wheel and the cap. 3 If the trouble occurs with multiple spindles: - Confirm the carrier stop position.	Only when specifications include FRD
E-90A	Main Drive System Overload	FL	An overload of the main drive system was detected.	Inspect the main drive system for any abnormalities.	
E-90B	Winding Drive System Overload	FL	An overload of the winding drive system was detected.	Inspect the winding drive system for any abnormalities.	
E-90C	Lifting Drive System Overload	FL	An overload of the lifting drive system was detected.	Inspect the lifting drive system for any abnormalities.	
E-90D	Drafting Drive System Overload	FL	An overload of the drafting drive system was detected.	Inspect the drafting drive system for any abnormalities.	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
E-92A	Main Motor Rev. Error	FL	The main motor speed (rpm) is abnormal.	1 Inspect the flyer drive system for any abnormalities. 2 Inspect the flyer encoder (PG1).	
E-92B	Winding Motor Rev. Error	FL	The winding motor speed (rpm) is abnormal.	Inspect the winding drive system for any abnormalities.	
E-92C	Lifting Motor Rev. Error	FL	The lifting motor speed (rpm) is abnormal.	1 Inspect the lifting drive system for any abnormalities. 2 If the problem occurs when loading empty bobbins, confirm whether there is any interference between the spindle and the bobbin.	
E-92D	Drafting Motor Rev. Error	FL	The drafting motor speed (rpm) is abnormal.	Inspect the drafting drive system for any abnormalities.	
E-93B	Winding Motor Overheats	FL	The winding motor (M2) temperature is abnormal.	1 Inspect the winding drive system for any abnormalities. 2 Don't restart the FL200 until the motor cools down.	
E-93C	Lifting Motor Overheats	FL	The lifting motor (M3) temperature is abnormal.	1 Inspect the lifting drive system for any abnormalities. 2 Don't restart the FL200 until the motor cools down.	
E-93D	Drafting Motor Overheats	FL	The drafting motor (M4) temperature is abnormal.	1 Inspect the drafting drive system for any abnormalities. 2 Don't restart the FL200 until the motor cools down.	
E-94	Twist is faulty	FL	The measured number of twists differs by 1% or more from the set value.	1 Inspect the flyer drive system for any abnormalities. 2 Inspect the flyer encoder (PG1). 3 Inspect the drafting drive system for any abnormalities.	
E-100	Synchronous Stop is Defective	FL	The FL failed to stop in synch with a power failure.	Confirm that the roving is not over/ under twisted. (Take the necessary actions according to the roving state.)	
INV1-E*	※Main inverter abnormality: an error code is displayed Example: INV1-E01 Over-current protection (At constant speed)	INV	A main inverter abnormality was detected. (Please refer to the inverter manual for details.)	A main inverter abnormality was detected. (Please refer to the inverter manual for details.)	
INV1-???	Error code is unknown	INV	Abnormalities were detected from the inverter, but the details cannot be determined.	Open a door with a breaker and take the necessary action according to the error code currently displayed on the panel of the inverter.	
INV1	Inverter is not ready	INV	The inverter is not in a state which will allow for operation.	1 Confirm if an INV1 error has occurred. 2 Turn the power supply OFF, then back ON, and try to start operation. 3 When an inverter panel is under operation, please place it in Monitor mode.	
INV1	Communication error	INV	Abnormalities occurred in the serial communication with the inverter.	Communications will be resent if an alarm reset is carried out. Check the following if this problem occurs frequently: 1 Check whether there are any breaks or poor contacts on the communication lines. 2 Check whether there is any cable which tends to generate noise near to the communication line.	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
AMP2-AL	※ Winding servo amplifier abnormality: an error code is displayed Example: AMP2-AL01 Over-current (OC)	AMP	(Check the content from the servo amplifier instruction manual)	(Check the content from the servo amplifier instruction manual.)	
AMP2	Amplifier type abnormality	AMP	The way of installing an amplifier is wrong.	1 Check whether the amplifier has been installed in a right position. 2 Check whether DIP SW1 of the amplifier has been set appropriately (see 7.1.2[7.2](2)). 3 Check whether there is disconnection or poor contact of a communication line.	
AMP2-A??	Error code is unknown	AMP	Abnormalities were detected from the servo amplifier, but the details cannot be determined.	Inspect the winding drive system for any abnormalities.	
AMP2	AMP is not ready	AMP	The servo amplifier is not in a state which will allow for operation.	1 Confirm if an AMP2 error has occurred. 2 Turn the power supply OFF, then back ON, and try to start operation. 3 If the FL200 cannot operate, inspect the wiring between the I/O board and the servo amplifier.	
AMP2	Communication error	AMP	Abnormalities occurred in the serial communication with the servo amplifier.	Communications will be resent if an alarm reset is carried out. Check the following if this problem occurs frequently: 1 Check whether there are any breaks or poor contacts on the communication line. 2 Check whether there is any cable which tends to generate noise near to the communication line.	
AMP3-AL	※ Lifting servo amplifier abnormality: an error code is displayed Example: AMP3-AL01 Over-current (OC)	AMP	(Check the content from the servo amplifier instruction manual)	(Check the content from the servo amplifier instruction manual.)	
AMP3	Amplifier type abnormality	AMP	The way of installing an amplifier is wrong.	1 Check whether the amplifier has been installed in a right position. 2 Check whether DIP SW1 of the amplifier has been set appropriately (see 7.1.2[7.2](2)). 3 Check whether there is disconnection or poor contact of a communication line.	
AMP3-A??	Error code is unknown	AMP	Abnormalities were detected from the servo amplifier, but the details cannot be determined.	Inspect the lifting drive system for any abnormalities.	
AMP3	AMP is not ready	AMP	The servo amplifier is not in a state which will allow for operation.	1 Confirm if an AMP3 error has occurred. 2 Turn the power supply OFF, then back ON, and try to start operation. 3 If the FL200 cannot operate, inspect the wiring between the I/O board and the servo amplifier.	

Error Code	Error Message	Classification	Explanation	Action to be taken	Specs.
AMP3	Communication error	AMP	Abnormalities occurred in the serial communication with the servo amplifier.	Communications will be resent if an alarm reset is carried out. Check the following if this problem occurs frequently: 1 Check whether there are any breaks or poor contacts on the communication line. 2 Check whether there is any cable which tends to generate noise near to the communication line.	
AMP4-AL	※ Drafting servo amplifier abnormality: an error code is displayed Example: AMP4-AL01 Over-current (OC)	AMP	(Check the content from the servo amplifier instruction manual.)	(Check the content from the servo amplifier instruction manual.)	
AMP4	Amplifier type abnormality	AMP	The way of installing an amplifier is wrong.	1 Check whether the amplifier has been installed in a right position. 2 Check whether DIP SW1 of the amplifier has been set appropriately (see 7.1.2[7.2](2)). 3 Check whether there is disconnection or poor contact of a communication line.	
AMP4-A??	Error code is unknown	AMP	Abnormalities were detected from the servo amplifier, but the details cannot be determined.	Inspect the drafting drive system for any abnormalities.	
AMP4	AMP is not ready	AMP	The servo amplifier is not in a state which will allow for operation.	1 Confirm if an AMP4 error has occurred. 2 Turn the power supply OFF, then back ON, and try to start operation. 3 If the FL200 cannot operate, inspect the wiring between the I/O board and the servo amplifier.	
AMP4	Communication error	AMP	Abnormalities occurred in the serial communication with the servo amplifier.	Communications will be resent if an alarm reset is carried out. Check the following if this problem occurs frequently: 1 Check whether there are any breaks or poor contacts on the communication line. 2 Check whether there is any cable which tends to generate noise near to the communication line.	

[3] List of Servo Amplifier Error Messages

Alarm	Alarm name	Detecting method	Cause and counter measures
AL01	Over-current (OC)	IPM of the power supply detected following troubles. 1 Over-current 2 Overheating 3 Gate power supply low	1 Short circuit or grounding of armature wire (U, V, or W). 2 Ambient temperature is higher than 55 degrees Celsius. Above problems are likely. If other causes are likely, contact the manufacturer.
AL02	Over voltage (OV)	Main circuit DC power supply (PN voltage) is over 800 VDC.	1 The motor is running with a speed greater than the max.rotation rate. 2 Acceleration causes overshoot exceeding the max. rotation rate. 3 High input power voltage.
AL03	Low PN voltage (PNLV)	Main circuit DC power supply (PN voltage) dropped below 300 VDC.	1 Low input power voltage. 2 If this alarm is issued during motor acceleration, power supply capacity shortage is likely.
AL04	Amplifier abnormal (ACINF)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL05	Amplifier abnormal (CROH)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL06	Resolver disconnected (RELV)	Resolver signal voltage between R1 and R2 dropped below 0.35 VAC.	Check that the resolver cable is not broken or disconnected. Test the voltage level between R1 and R2. (It should be over 0.35 V in the AC range.)
AL07	Power status error (POWFAIL)	CPU cannot judge the amplifier type.	1 CPU's software version is not consistent with the unit configuration. 2 The amplifier is out of order. Above problems are likely. Please contact the manufacturer.
AL08	Amplifier abnormal (SOH)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL09	Amplifier abnormal (RGOH)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL10	Amplifier abnormal (RGST)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL11	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL12	DSP error (DSPERR)	DSP stopped working.	The amplifier is out of order. Please contact the manufacturer.
AL13	Amplifier abnormal (BLV)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL14	Brake error (BERR)	1 When the dynamic brake is used, brake output turning ON did not generate the brake confirmation signal input.3 2 When the holding brake is used, brake output turning ON kept the brake confirmation signal ON.	Read the descriptions on the dynamic and holding brake connections and check the wiring and used accessories.
AL15	Over-current detection (OCS)	The motor current exceeded 120% of the current limit	1 The motor in rotation was locked mechanically. 2 Short-circuit or grounding of the U, V, and W phases of setting. the motor. 3 Erroneous setting of the parameter UP-02 (Motor application)

Alarm	Alarm name	Detecting method	Cause and counter measures
AL16	Speed amplifier saturation (VAS)	The speed amplifier was saturated and current exceeding the maximum level flew more than 3 seconds.	1 The motor is locked mechanically. 2 The load inertia is too great to accelerate or decelerate. 3 Erroneous setting of the parameter UP-02 (Motor application)
AL17	Motor overload (MOL)	Motor temperature calculated from the actual load level rose exceeding 110% of the maximum temperature setting.	1 Load is too much for the motor output capacity. 2 Operation cycles are too short for the motor capacity.
AL18	Instant thermal (POL)	This alarm is issued when output current is more than 120% of the motor rated current.	1 The motor is locked mechanically. 2 Load is too much for the motor output capacity. 3 Erroneous setting of the parameter UP-02 (Motor application)
AL19	Resolver error (RESERR)	The resolver feedback counter made erroneous counting.	1 Bad contact of the resolver cabling. 2 The resolver cable is installed near the power line and affected by noises. Check the resolver cable. 3 The ground line between the motor and the amplifier is broken or disconnected.
AL20	Overspeed (OSPD)	The rotation rate exceeded 120% of the maximum rotation setting.	1 The servo adjustment value is overshooting.Couduct auto tuning. 2 A command value was too much. 3 Bad contact of the resolver cabling. 4 The resolver cable is installed near the power line and affected by noises. 5 The ground line between the motor and the amplifier is broken or disconnected.
AL21	Deviation counter over (FULL)	Accumulated pulses in the deviation counter exceeded the following detection level. $\text{etection level} = \frac{\text{Motor maximum rotation rate}}{60} \times \frac{\text{Sensor split count}}{\text{TP2}} \times 1$ **EXAMPLE:** Max.rpm 2000 rpm, Motor sensor:resolver Target loop gain TP2 = 60 $\text{Detection level} = \frac{2000}{60} \times \frac{24000}{\text{TP2}} \times 10 = 133000 \text{ pulses.}$	1 Load is too much for the motor output capacity. 2 The load inertia is too great to accelerate or decelerate. 3 The value for TP2 (Target loop gain) is set too high. 4 Current limit is set too low.
AL22	Amplifier abnormal (ABSE)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL23	Amplifier abnormal (ACN)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL24	Amplifier abnormal (BAL)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL25	Amplifier abnormal (OPALM)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL26	Parameter setting error (CERR)	Parameters UP-01 (Control mode) and UP-02 (Applicable motor) are not set, or set with invalid values.	This alarm is issued on the first power input. Set the user parameters UP-01 and UP-02, turn off the machine, make sure that the display went off, and then turn on the machine again.
AL27	Amplifier abnormal (AEERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL28	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.

Alarm	Alarm name	Detecting method	Cause and counter measures
AL29	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL30	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL31	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL32	Zero point saving error (MZE)	This alarm is issued together with AL06, AL19, AL22, AL23, and AL27.	Read the descriptions on AL06, AL19, AL22, AL23, and AL27.
AL33	Amplifier abnormal (CLD)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL34	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL35	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL36	Amplifier abnormal (ABT)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL37	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL38	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL39	Amplifier abnormal (ILLERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL40	Amplifier abnormal (EREE)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL41	Amplifier abnormal (ETER)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL42	Amplifier abnormal (EBACK)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL43	Amplifier abnormal (ECKER)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL44	Amplifier abnormal (EBAL)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL45	Amplifier abnormal (EABSE)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL46	Amplifier abnormal (EOSPD)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL47	Amplifier abnormal (EWER)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL48	Amplifier abnormal (EINT)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.
AL49	Amplifier abnormal (PHSERR)	The amplifier is out of order.	The amplifier is out of order. Please replace the amplifier.

[4] Detailed Recovery Actions

[4.1] If "E-15 Oil Circulation Abnormality" appears

(1) Error detection

The controller monitors the oil pressure in the oil circulation system when the FL200 is in ordinary operation (except during acceleration and deceleration). If the PS1 oil pressure sensor's contact (between 104 and E12) stays ON for 10 seconds or more, signaling a low oil pressure state, then the controller issues error code E-15.

The oil pressure sensor PS1 should turn off if the oil pressure increases.

(2) Actions to be taken

1) Check whether oil is flowing at the inlet and outlet of the oil pump.

If oil is flowing:

- Check the joints of the piping tube for connection.
- Check that oil comes out from the outlets of the piping ends, e.g., differential gear box.
- If there is no problem with the above two items, check whether the machine speed is too low or the oil viscosity is high.

If no oil is flowing:

- Check that there is the specified amount of oil in the oil tank.
- Check that the oil inlet of the nylon tube lies below the oil level.
- Check the oil filter for clogging.
- Check that neither the pump drive shaft or bearing is broken.
- Check that the pump is not faulty.

2) If there is no problem with the above items, run the FL200 again and check whether oil comes up to the oil pressure sensor within 10 seconds.

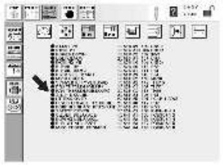
3) If the error message appears again although oil has circulated normally,

a. On the I/O Monitor screen, check that the input for oil pressure sensor PS1 is ON when the FL200 is halted.

b. Disconnect pin 104 from terminal block TB120 within the Control Box (A-BOX) and check whether the input for the oil pressure sensor goes OFF on the I/O Monitor screen.

- If the input remains ON, replace the I/O2 board of PCB1.

3) The I/O monitor for input to the oil pressure sensor PS1.



- If it goes OFF, replace the oil pressure sensor PS1.

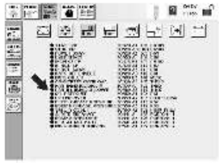
[4.2] If "E-16 Oil Pressure Sensor Malfunction" appears

(1) Error detection

The controller monitors oil pressure sensor PS1 (for diagnosis of the sensor itself) when the FL200 is halted. If the oil pressure sensor's contact (between 104 and E12) stays OFF for 10 seconds or more, signaling a high oil pressure state, then the controller issues error code E-16.

Oil pressure sensor PS1 should turn off if the oil pressure increases.

1)The I/O monitor for input to the oil pressure sensor PS1.



(2) Actions to be taken

1) On the I/O Monitor screen, check whether the input of oil pressure sensor PS1 is ON when the FL200 is halted.

- If the input is ON, skip to step 3).
- If it is OFF, go to step 2).

2) 2) Check the wiring as explained below:

Check terminals 104, E12, and connector I/O2-CN59 between oil pressure sensor PS1 and terminal board TB120 inside the control box (A-BOX).

If there is no problem with the wiring, short-circuitterminals 104 and E12 of terminal board TB120. Then check whether the input for oil pressure sensor PS1 comes ON on the I/O Monitor screen.

- If the input stays OFF, replace the I/O2 board of PCB1.
- If it goes ON, replace the oil pressure sensor PS1.

3) Run and stop the FL200 again, then check that oil flows out of the oil pressure sensor within 10 seconds.
If it takes more than 10 seconds, check the oil filter for clogging.

[4.3] If "E-17A Flyer grease lubrication abnormality (pressure does not rise)" or "E-17B Bobbin grease lubrication abnormality (pressure does not rise)" appearsensor PS1.

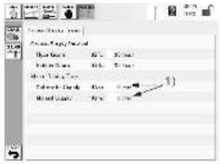
(1) Error detection

If the general greasing system has been set to ON, the controller starts monitoring flyer grease pressure sensor PS2 and bobbin grease pressure sensor PS3 the moment either of the greasing pump motors is turned on, regardless of manually or automatically.

If PS2 or PS3 has not come ON even once within the lubrication motor running time, the controller issues error code E-17.

Grease pressure sensor (PS2, PS3) should be turned on if the grease pressure increases.

1)Setting screen for the lubrication system



(2) Actions to be taken

If there is an abnormality with the lubrication of the flyers or bobbins, check the problem by following the instructions below.

1) Make sure that the run time of the pump motor is set to five minutes or more. (If it is set to less than 5 minutes, the pump motor may stop before the grease pressure rises.)

2) Check that there is more than the specified amount of grease in the grease tank.

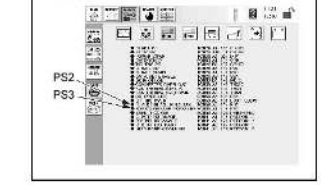
3) Check the lubricant filter for clogging. If it is clogged, clean it.

4) Check that no air bubbles are entrapped in the grease tank. Let air bubbles out of the tank if any.

5) Check the piping of the greasing system for grease leakage. If any leakage is found, tighten the joints.

6) Check that the constant flow valves (the discharge valves on spindles) are not faulty. If any of them is faulty, disassemble and clean it.

If there is no problem with the above mechanical items, proceed to the following electrical checks:



8)Monitoring the input of grease pressure sensor PS2

7) Check the wiring related to the grease pressure sensors (PS2 and PS3). (Terminals No. 117, 119, E12, and connector I/O2-CN59)

8) On the I/O Monitor screen, confirm that that the input for the grease pressure sensors (PS2 and PS3) is OFF. Then short-circuit terminals 117 and E12 or 119 and E12 of terminal block TB120 inside the control box (A-BOX) and check whether the input comes ON.

- If the input stays OFF, replace the I/O2 board of PCB1.
- If it goes ON, replace the grease pressure sensor PS2 or PS3.

NOTE: To clear the E-17 error code, turn the power off and on.

[4.4] If "E--18A Flyer grease lubrication abnormality (pressure does not fall)"or "E-18B Bobbin grease lubrication abnormality (pressure does not fall)" appears

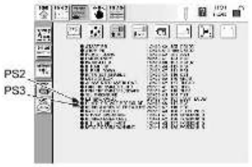
(1) Error detection

If the general greasing system has been set to ON, the controller checks that flyer grease pressure sensor PS2 and bobbin grease pressure sensor PS3 are OFF (for diagnosis of those sensors) immediately before either of the greasing pump motors is turned on, regardless of manually or automatically.

If either of PS2 or PS3 is ON, the controller issues error code E-18.

Grease pressure sensor (PS2, PS3) should be turned on if the grease pressure increases.

3)Monitoring the input of grease pressure sensor PS2 and PS3



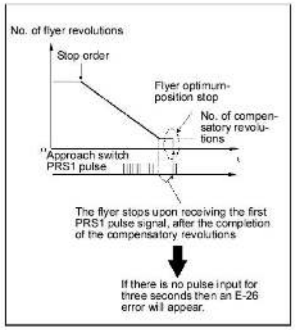
(2) Actions to be taken

1) Check that grease is not more viscous than specified.
(Specified viscosity: NLGI No. 1)

2) Check for no foreign materials on contacts or springs inside PS2 or PS3. Clean the inside if necessary.

3) On the I/O Monitor screen, confirm that the input for the grease pressure sensors (PS2 and PS3) is ON. Then disconnect grease pressure sensor PS2 or PS3 that is connected to terminals 117 and E12 or 119 and E12 of the terminal block TB120 inside the control box (A-BOX) and check whether the input goes OFF.

- If the input stays ON, replace the I/O2 board of PCB1.
- If it goes OFF, replace the grease pressure sensor.


No. of flyer revolutions
Stop order
Flyer optimum-position stop
No. of compensatory revolutions
Approach switch
PRS1 pulse
The flyer stops upon receiving the first PRS1 pulse signal, after the completion of the compensatory revolutions
If there is no pulse input for three seconds then an E-26 error will appear.

[4.5] If "E--26 Optimal Flyer Position Switch is Abnormal" appears

(1) Error detection

At the time the FL200 is halted, the controller counts the number of pulses issued from the optimal position stop sensor (PRS1) in order to stop the flyers at the optimum angle after slacking roving.

If no pulse is issued from the PRS1 or if the controller fails to detect the pulses, the FL200 will not be stopped. To prevent this, if the controller cannot detect the pulses for three seconds, it issues error code E-26 and stops the FL200.

(2) Actions to be taken

1) Check the clearance between the PRS1 and the sensor dog. (Normal clearance is about 3.0 mm)

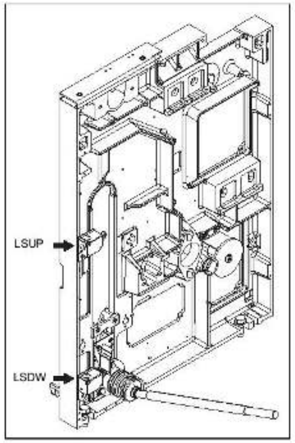
- If there is an abnormality: readjust the clearance.

2) Turn the PRS1 ON and OFF to check that the sensor LED goes on and off.

- If the sensor LED is always on, replace the PRS1.
- If it is always off, go to step 3).

3) Check the wiring for any looseness or breakage. (Terminals No. 100 and E12, and connector I/O1-CN40 of terminal block TB120 inside the control box (A-BOX))

- If there is any problem, fix it.
- If there is no problem with the wiring, replace the I/O1 board of PCB1.



[4.6] If "E-27 Excessive Raising or Lowering of the Bobbin Rail" appears

(1) Error detection

When the bobbin rail limit switch dog activates the upper limit switch (LSUP) or lower limit switch (LSDW) an error message will appear and the machine will stop.

The LSUP and LSDW are set so that they will activate if the bobbin rail tries to go beyond the set limits, since this would be dangerous.

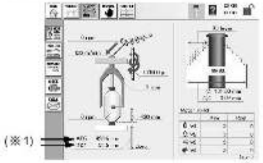
NOTE: The LSUP and LSDW limit switches input a point of contact signal to the main controller and at the same time also send an emergency stop signal to the lifting servo amplifier. This is done in an effort to further raise the safety of the FL200.

(2) Actions to be taken

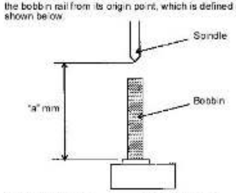
1) If normal reversing occurs during spinning operation, but the LSUP is activated, the position of the LSUP is too low. Make adjustments to raise the LSUP up a little.

2) If overrun beyond the shoulder (the bobbin rail inverting position) occurs during spinning operation, or if reversing occurs behind the normal reversing position, then try replacing the M3 servo motor or AMP3 servo amplifier.

3) Sub-monitor screen



NOTE 1
Each of the bobbin rail position values (ABS and INC) shown on the Sub-monitor screen denotes the movement of the bobbin rail from its origin point, which is defined as shown below.



FL specifications	"a" (mm)
Equipped with FRD	498
Others	494

[4.7] If "E-28 Bobbin Rail Position fault" appears

(1) Error detection

To detect the current bobbin rail position, the FL200 is equipped with two detectors, an absolute encoder PG0 and a servo motor resolver PG3. As shown at left, the current bobbin rail positions (ABS and INC) detected by those detectors are displayed on the operation panel.

If the difference between the ABS and INC values exceeds 3 mm, the controller issues error code E-28 and stops the FL200. (The bobbin rail can be moved independently.)

(2) Actions to be taken

1) If all of the set values are reset to their initial values at the same time that this error occurs:

Refer to Section 7.1.5 [1] Main Control Board Lithium Battery Life.

2) If the bobbin rail was moved by manual handle operation while the power was OFF, press the Bobbin Rail-down switch to move the bobbin rail down to the doffing position and then press the Alarm Reset key.

3) Compare the detected bobbin rail positions (ABS and INC) shown on the Sub-monitor screen with the actual bobbin rail position, and determine which encoder is abnormal.
(See NOTE 1.)

If it is hard to determine, move the bobbin rail up and down with the handle to see how each of the detected bobbin rail position values changes.

If the ABS value is abnormal, go to step 4).

If the INC value is abnormal, skip to step 5).

4) Check the PG0-related wiring (connector I/O2-CN56).

Replace the absolute encoder PG0.

If the error persists, replace the I/O2 board of the PCB1.

5) Check the PG3-related wiring (connectors AMP3-CN5, PG3, AMP3-CN2, PCB4-CN3, CN4, and I/O1-CN26 of PCB1).

Replace servo amplifier AMP3 and servo motor M3.

If the error persists, replace the I/O1 board of PCB1.

[4.8] If "E-30, 31, 32 Tension Sensor Head 1, 2, or 3 is Abnormal" error appears

If the tension sensor detects any abnormal value during spinning, the controller regards it as a sensor head error. It then displays an error message and stops the FL200.

(1) Error detection

1) If "gorigin position plus 10 bit or more data" is detected for approximately 3 seconds or longer, 10 seconds after the start of operation.

2) If while the FL200 is in regular operation, a sensor error signal ("999" will be displayed) such as when there is no roving, is detected for approximately 10 seconds or longer.

(2) Actions to be taken

1) Clean off any stains or dust that have adhered to the tension sensor window.

2) Check that the tension sensor is installed properly and is not loose.

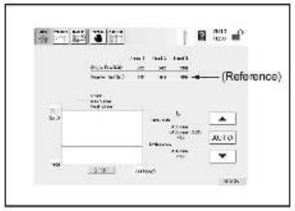
3) Check that the flyer caps are fixed in place properly.

4) Check that the connector (I/O2-CN58 of PCB1) is inserted properly.

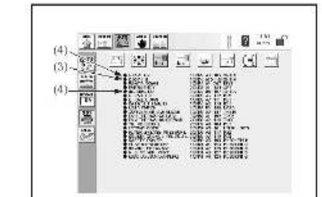
5) Conduct the origin point adjustment again.

6) If the error persists after taking the steps listed above, replace the tension sensor assembly completely.

REFERENCE: If the roving position data cannot be obtained due to no roving or two roving threads passing through the same tension sensor, a "999" will appear as the sensor head monitor value on the tension bit display.



8.1.2 Troubleshooting According to the Symptoms



(4) Stop switch — When released: ON
When pressed: OFF

(5) Start or Inching switch — When released: OFF
When pressed: ON

[1] Failure to Run or Inch (None of the Three Motors can Run.)

(1) If pressing the Start or Inching switch in a particular 3-switch set cannot run the FL200:

- Check the wiring of the inoperative switch. (Terminals No. 106, 107, P24)
- Check the contact of the inoperative switch for contact failure.
- Replace the inoperative switch.

(2) Confirm that the LED, which verifies the operation of the microprocessor on the CPU board, is in its normal state. If the LED is abnormal carry out the following. (Refer to Section 7.1.2 [2])

- Confirm that that 5V power supply to the CPU has the proper voltage. If not, make the necessary adjustments. (The volume of power supply board PCB2 is VR4)
  Proper voltage: 5.00 to 5.15 V
- Replace the CPU board.

(3) When the Stop switch is not pressed, check the input of the Stop switch on the PII Board Monitor screen.

- If no input is monitored, check the Stop switch circuit, referring to Subsection 8.1.2 [5.1] (1).

(4) When each of the Start switch and Inching switch is pressed, check the input of each switch on the PII Board Monitor screen.

- If no is no input, check the wiring for any breaks or loose connections. (Relays CR105, CR106, and CR107. Connector I/O1-CN28. Terminals No. 106, 107, and P24)
- If the wiring is normal, replace the I/O1 board of PCB1.

(5) Confirm that the direct current power supply to the inverter and servo amplifier has the proper voltage.
Proper value: Voltage between P-N is DC 513V or more.

- If the voltage between P-N is abnormal, replace the converter CONV1.

[2] Motors Can Run But They Are Not Synchronized with Each Other

[2.1] The FL200 can continue running but no proper roving tension can be kept

(1) If roving on particular spindles are abnormally slacked or tensed:

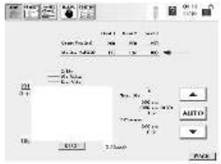
- Check whether cops on those spindles are short-wound.
- Check the flyer pipes for clogging. Clean the inside of those pipes if clogged.
- Check the sliver grain type. If different sliver grain are found, replace their cans with the cans of the correct grain.
- Check the number of presser windings. Check that roving are not slipped out of the presser eyes.
- Check the presser shapes and the contact surfaces with the paddles. If they are different from those of other spindles due to deformation or wear, replace the pressers.

(2) If roving on all spindles (including three sensor-equipped spindles) are abnormally slacked or tensed:

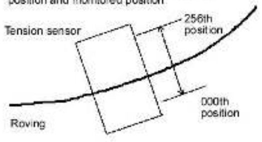
- Check the zero point of the roving tension sensor.
  If it is off, set the zero point again. (Refer to Section 7.1.3 [3])
- Check whether the roving tension on any of the three sensor-equipped spindles is abnormal. (Refer to Section 7.1.3 [3])

  If this tension-related error occurs frequently on any of the three sensor-equipped spindles, decrease the preset Tension Discrimination Factor. (Refer to Subsection 8.1.4 [2])
- Modify the tension target value to decrease or increase the tension.

(3), (4) Tension Bit Display screen



(4)Relationship between the actual roving position and monitored position



(3) On the Tension Bit Display screen, check the bit monitor of each tension sensor head.

- If "999" is displayed regardless of roving existence, clean the tension sensor window. If the error persists, replace the tension sensor.

(4) Check whether the monitored position value increases or decreases correspondingly as the actual roving passing through the sensor detection area moves up or down on each of the three sensor-equipped spindles.

- If the relationship between the monitored value and the actual roving position is abnormal on all three sensor-equipped spindles:
  - Check the wiring (connector I/O2-CN58, and terminals 150, 151, and P12).
  - If the wiring is normal, replace the I/O2 board of PCB1.
- If the relationship is abnormal on one or two sensor-equipped spindles, replace the tension sensor.

[2.2] The FL200 cannot continue running due to no synchronization (Some particular parts are obviously assumed to be defective.)

(1) Make sure that set values are not modified.

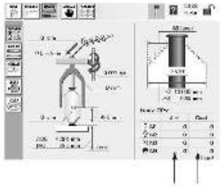
(2) Remove roving from all of the three sensor-equipped spindles and check whether the bit monitor of each tension sensor head shows "999" on the Tension Bit Display screen. (Refer to the diagram in Section 8.1.2 [2.1].)

- If any one of the bit monitors shows a value other than "999," clean the tension sensor window and check that "999" appears.
- If "999" persists, replace the tension sensor.

(3) Check whether the monitored tension bit value increases or decreases correspondingly as the actual roving passing through the sensor detection area moves up or down on each of the three sensor-equipped spindles. (Refer to the diagram in Section 8.1.2[2.1].)

- If the relationship between the monitored value and the actual roving position is abnormal on all three sensor-equipped spindles:

(4) Sub-motor screen

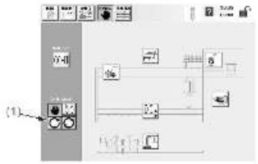


   - Check the wiring (connector I/O2-CN58, and terminals 150, 151, and P12).
   - If the wiring is normal, replace the I/O2 board of PCB1.
- If the relationship is abnormal on one or two sensor-equipped spindles, replace the tension sensor.

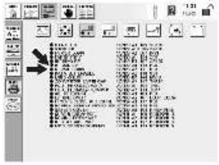
(4) Use the individual drive function of each motor to operate each spindle individually. Identify the spindle which does not rotate as ordered. (Refer to Section 7.1.3[22])
In order to carry out the identification procedure, open the sub-motor screen and confirm the difference between the target number of revolutions for each motor and the number of actually measured revolutions.

- In the case that the drive system of the main motor is faulty.
   - Confirm if the set value for the inverter INV1 is normal or not. (Refer to Section 7.1.2[6])
   - Check the wiring. (INV1 terminal. I/O1-CN24, CN16, CN43)
   - If the wiring listed above is normal, replace the I/O1 board of PCB1 or Inverter INV1.
- In the case that the drive system of the winding motor is faulty.
   - Check the wiring. (CN8 of AMP2, CN5, CN2, CN3, CN4, I/O1-CN22)
   - If the wiring listed above is normal, replace the I/O1 board of PCB1 or servo amp AMP2, servo motor M2.
- In the case that the drive system of the drafting motor is faulty.
   - Check the wiring. (CN8 of AMP4, CN5, CN2, CN3, CN4, I/O2-CN61, CN62)
   - If the wiring listed above is normal, replace the I/O2 board of PCB1 or servo amplifier AMP4, servo motor M4.

(5) Check the mechanism as follows:
- Check the couplings of the bobbin drive shaft for looseness.
- Check the set screws inside the differential gear box for looseness.



(3)Monitoring the input of the Bobbin Rail-up and -down switches



[3] Independent Bobbin Rail Movement Failures

[3.1] Pressing the Bobbin Rail-up or -down switch does not move the bobbin rail

(1) Confirm if the doffing mode selection switch is set to the manual operation position.

(2) If you have pressed the Bobbin Rail-up switch before the bobbin rail has completely moved down to the doffing position, move the bobbin rail completely down to the doffing position and then move it up.

(3) When each of the Bobbin Rail-up and -down switches is pressed, check the input of each switch on the PII Board Monitor screen.

- If no input is monitored, check the wiring. (Connector I/O1-CN28, and terminals No. 111, 112 and P12).
- If the wiring is normal, replace the I/O1 board of PCB1.

(4) Check the lifting servo amplifier and servo motor.

- Check the wiring. (CN8 of AMP3, CN5, CN2, CN3, CN4, I/O1-CN18)
- If the wiring listed above is normal, replace the I/O1 board of PCB1 or servo amplifier AMP3, servo motor M3.

[3.2] The bobbin rail does not stop at the specified stop position

(1) Check the zero point of the bobbin rail.

(2) Replace servo amplifier AMP3 or servo motor M3.

[4] Roving Cutting Failures at Full-bobbin State

Turn the doffing mode selection switch to the manual position and then observe the roving state at the time of full-bobbin stop.

[4.1] Roving are cut in the flyer pipes or at the outlet of the front rollers

(1) Confirm the amount of reverse bobbin rotation, and if the reverse rotation amount is insufficient at the time of full-bobbin stop:

- On the Stop Sequence screen, increase the bobbin reverse rotation amount ("Winding Reverse Length for Doffing").
  (Example: From 20 mm to 50 mm)

(2) Try increasing the hard twist rotation setting.
(Example: 8 times to 12 times)

NOTE: For other more detailed adjustments, please refer to Section 6.1.4.

[4.2] Roving cannot be cut

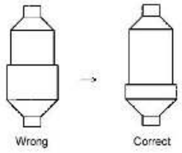
(1) If the full-bobbin stop position is too high:

- Decrease the stop position value.
  (Example: From 180 mm to 130 mm)

(2) If bobbins rotate in the reverse direction excessively at the time of full-bobbin stop:

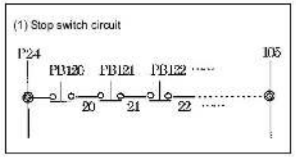
- Decrease the bobbin reverse amount ("Winding Reverse Length for Doffing").
  (Example: From 100 mm to 50 mm)

(1) Modifying the stop position



[5] False Stops

[5.1] A false stop occurs without displaying any error message

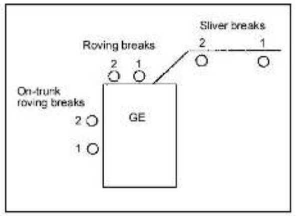


(1) If the FL200 stops normally as in regular stop, the Stop switch circuit might have operated instantaneously.

- Check the wiring and terminals of the Stop switch circuit (shown at left) for looseness.
- Check the B-contact of the Stop switch for contact failure.

(2) If roving breaks on all spindles and the FL200 stops in an abnormal state, the CPU might reset. Confirm that that 5V power supply to the CPU has not gone down. If the voltage has decreased, make the necessary adjustments. (The volume of power supply board PCB2 is VR4)
Proper voltage: 5.00 to 5.15 V

[5.2] A false stop occurs due to the misdetection of the stop motion



(1) On each of the photoelectric switches of the stop motion, check whether the optical axis between the light emitter and receiver is interrupted by fly or fleece.

- Remove fly or fleece. Clean the lens surfaces of the light emitter and light receiver.

(2) Check if any devices scattering fly or fleece are placed near the FL200.

(3) Adjust the optical axis and the sensitivity of the photoelectric switch causing misdetection.

(4) If the error persists after the adjustment made in step (3) replace the parts listed below in this order:

- Amplifier board PCB3
- The photoelectric light emitter and receiver that made the false detection (PHR1 to 8, PHL1 to 8).

(5) If a false stop occurs due to the misdetection of on-trunk roving breaks:

- Check the closing angle of the flyer safety covers. If those covers interfere with the optical axis of the photoelectric switch provided for on-trunk roving breaks, adjust the closing angle (only if your FL200 is equipped with a flyer safety cover).

[6] Function Panel Screen-Related and Data Setting Failures

[6.1] Unable to select another screen

(1) Try pressing the F2 HOME key.

(2) Confirm that the LED, which verifies the operation of the microprocessor on the CPU board, is in its normal state. (Refer to Section 7.1.2 [2])
If it is normal, confirm that that 5V power supply to the CPU has the proper voltage. If not, make the necessary adjustments.
(The volume of power supply board PCB2 is VR4)
Proper voltage: 5.00 to 5.15 V

(3) Check the LAN cable between the function panel and the CPU board.

(4) Replace the parts below in this order:

- Function panel DISP1
- CPU board

[6.2] The display has turned black (Touching the screen surface displays nothing.)

(1) Check that the voltage is AC 100V.

- If the voltage across wires 351 to 352 is within AC 100V ± 10%, then it is OK.

(2) Check the wiring of electrical power wires 351 to 352, which feed power to the function panel DISP1.

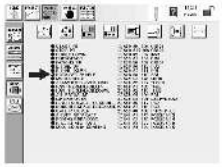
(3) Replace function panel DISP1.

[6.3] Data entry is impossible

(1) Turn the setting-enable (DATA SET) key switch SS1 clockwise and check on the I/O Monitor screen that the input of the switch is ON. If the input does not come ON:

- Check the wiring (connector I/O1-CN28, and terminals No.116 and P12).
- Replace the setting-enable (DATA SET) key switch SS1.
- Replace the I/O1 board of PCB1.

(1)Monitoring the input of the setting-enable switch



[6.4] All of the set data has been reset to the initial values

(1) Replace the lithium battery on the CPU Board. (Refer to Section 7.1.5[1])

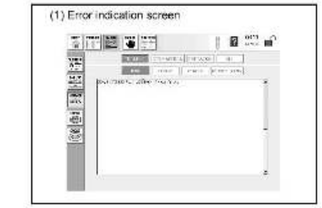
[7] Abnormal States during Power Failure

If roving are slacked to the extent that they come into contact with the flyer rail covers:

(1) Turn off the circuit breaker on the FL200.
(2) Open the front cover of the GE head and rotate the bobbin motor pulley by hand to take up the slacked roving.
(3) After power is supplied again, turn on the circuit breaker.
(4) Press the Alarm Reset key.
(5) Press the Inching switch to run the FL200 while adjusting the roving tension until a single layer is almost wound.
Then, go into ordinary operation.

If the roving has run out or some other problem has developed so that operation is no longer possible:

(1) Error indication screen



(1) After power has been restored, open up the Trouble History screen.

(2) At the time of the power failure an "E-64 Power Failure" error message will be displayed. Confirm if there were any other errors that occurred at that same time.

(3) If the display shows a main inverter trip "INV1-E**":

- Check the wiring (INV1 terminal, I/O1-CN16, CN43, CN28)
- Confirm if all the inverter INV1 parameter settings are normal or not.
- Try replacing the parts listed below:
  - Inverter INV1
  - I/O1 board of PCB1
  - Condensers C10, C11 (C12, C13)

(4) If the display shows a servo-related trip "AMP*-AL**"
(If the inverter is not tripped)

- Check the wiring around the servo amplifier and servo motor where the error occurred.
- Try replacing the servo amplifier and servo motor where the error occurred.

NOTE: The FL200 may not always succeed in power failure stop sequence due to the power feeding facilities of your plant or power failure timing. Even if the power failure stop sequence fails once, do not replace parts.

[8] Deformed Bobbin Shoulders

[8.1] Bobbin shoulders deformed on particular spindles

(1) Check the roving tension on those particular spindles.

If the roving tension is abnormal, take the same recovery actions as given in Subsection 8.1.2 [2.1] (1).

(2) Check the presser shapes. Check that roving are not slipped out of the presser eyes.

[8.2] Bobbin shoulders deformed on all spindles

(1) Check whether the FL200 was stopped by pressing the Stop switch or Inching switch when it was winding roving around the bobbin shoulders.

- Avoid stopping the FL200 when it is winding roving around the bobbin shoulders.

(2) Check whether the FL200 was stopped by the stop motion when it was winding roving around the bobbin shoulders.

- Make the set value for the "Rev. rate avoid stop SSR" larger.

(3) If bobbin shoulders become deformed at the same wound percentage of bobbins, check the roving tension at that wound percentage.

- Raise the target roving tension value.
- Change the target roving tension setting switch from automatic to manual and then adjust the roving tension according to the wound percentage.

(4) Check whether the bobbin rail was moved by the manual handle when the power was off.

- Avoid moving the bobbin rail when the power is off.

(5) Check the shoulder angle of the packages.

- If the set value for the "shoulder angle" is too large, then make this value smaller.

(6) f bobbin shoulders always become deformed or shapeless and it is clear that those failures result from the abnormal reverse position of the bobbin rail, check the items listed below:

- Confirm if there is any wear or other trouble with the gears inside the lifting gear box.
- Check the wiring related to the lifting servo amplifier and servo motor.
  (CN8 of AMP3, CN5, CN2, CN3, CN4, I/o1-CN18)
- If the wiring is normal, then try replacing the parts listed below:

(I/O1 board of PCB1, servo amplifier AMP3, servo motor M3)

[9] Other Failures and Abnormalities

[9.1] The flyer runs rough (does not spin smoothly)

(1) Check the timing belt of flyer encoder PG1 for any abnormalities.

(2) Check the set parameter values of the inverter INV1 for any mistakes.

(3) Check the wiring listed below:
(INV1 terminal, I/O1-CN24, CN16, CN43)

(4) Replace the parts listed below in this order:

- Flyer encoder PG1
- Main inverter INV1
- I/O1 board of PCB1
- Main motor M1

8.1.3 Reference Materials

[1] Voltage Check List

Your name____	Frame No.____	MFG No.____	Checked on:____ (date)

No.	Voltage checking location	Check pins	Rated voltage	Allowable voltage range	Measured voltage level		Comments
					On halt	In operation	
1	Circuit breaker CB1, secondary side (Input voltage)	R1-S1-T1	Line voltage	Line voltage ±5%	(R1-S1) ___ VAC (S1-T1) ___ VAC (R1-T1) ___ VAC	(R1-S1) ___ VAC (S1-T1) ___ VAC (R1-T1) ___ VAC	
2	Inverter terminal board	P-N	Line voltage × 1.35	(Line voltage × 1.35) ±5%	___ VDC	___ VDC	
3	Breaker CB3 secondary	R4-S4-T4	200 VAC	200 VAC ±5%	(R4-S4) ___ VAC (S4-T4) ___ VAC (R4-T4) ___ VAC	(R4-S4) ___ VAC (S4-T4) ___ VAC (R4-T4) ___ VAC	
4	Transformer TF1 and circuit protector CB4	351-352	100 VAC	100 VAC ±5%	___ VAC	___ VAC	
5	Power supply board (PCB2)	300-301	30 VAC	30 VAC ±10%	___ VAC	___ VAC	
7		P24-E24	24 VDC	24 ± 0.5 VDC	___ VDC	___ VDC	
9		P12-E12	12 VDC	12 ± 0.1 VDC	___ VDC	___ VDC	
10		P5-E5	5 VDC	DC 5.00 to 5.15V	___ VDC	___ VDC	
11		P15-E15	15 VDC	15 ± 0.7 VDC	___ VDC	___ VDC	
12		E15-N15	15 VDC	15 ± 0.7 VDC	___ VDC	___ VDC	

[2] Spinning Condition Check Sheet

CC:		
	Test Evaluation Office	

FL200 Spinning Condition Check Sheet

Date of inspection . .

Delivery destination (country) ( ) Account No. Reporter

		Type of fiber	Mixed spinning ratio	Fiber length(mm·in)	Fineness(d·μg/in)	Thread count(Ne)	[illegible]	Machine number	Hours of operation
Temperature	°C ①								/day
Humidity	%RH ②								/day

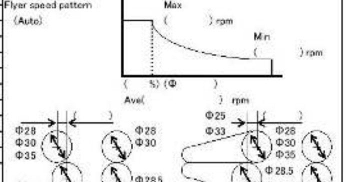
	Item	Units	
Sliver conditions	Drawing frame manufacturer's name	—	
	Type of drawing frame	—	
	Fixed quantity of supply	Ne,gr/6yds	
	Can size (diameter x height)	inch,mm kg,lbs	
	U%(UT3)	%	
Spinning conditions	Fixed quantity of roving	No.gr/30yds	
	Weight of each bobbin	kg,lbs	
	Roving speed (average)	m/min	
	No. of twists	T/inch	
	No. of	—	
	No. of presser windings	Windings	
	Full bobbin length set value	m,yd	
	Full bobbin diameter (Monitor value)	mm	
	No. of full bobbin layers	Layers	
	Roving tension (Tension sensor)	A: B: C: AIM:	
	No. of broken roving threads	Threads / 100SP/H	
	Roving strength	g/Lengths	
	Operational efficiency	%	
	U%(UT3)	%	
	Flyer caps front row		
	back row	Smooth, grooved, high cap	

Specifications	Staff (mm)	520·440
	No. of spindles	120·106·96·( )
	Type of flyer	Slit / pipe
	Type of presser	Normal / Bunch winding
	Type of arm	PK1500-001938·-02
	Type of cradle	OH(514·524·534)
Change gear	TDC	T( )
	BDC	T( )
Maintenance	Regular cleaning cycle	
	maintenance cycle	
	Rubber cot Manufacturer	
	Rubber cot Hardness	
	Rubber cot Polishing cycle	
	Rubber cot Processing	

Notes

Arm load (Kg)				
3 lines	20·25·30	------	10·15·20	15·20·25
4 lines	9·12·15	15·20·25	10·15·20	10·15·20
Color	B·G·R	B·G·R	B·G·R	B·G·R

Flyer speed pattern
(Auto)



Front collector (mm)		Tenser gauge		Condenser(mm)	Sliver guide(mm)
4 lines	3 lines				
3 6 4 7 5 8 5.5	7 11 8 12 9 14 10	RED YELLOW WHITE GRAY BLACK	ORANGE BEIGE GREEN BLUE BROWN	8 10 12 15 18	11 × 3.5 13 × 3.5 15 × 3.5 17 × 4.0 18 × 8.0

SIMULTANEOUS ROVING DOFFER INSTRUCTION MANUAL

Model FRD

(FIRST EDITION)

Thank you for purchasing the FRD Type Simultaneous Roving Doffer.

This instruction manual describes the correct installation, operating principles, function, adjustment, and maintenance of the FRD motions, all of which should be familiar to all personnel concerned.

Before operating, adjusting, or maintaining the FRD, be sure to read this manual carefully to understand the FRD.

Introduction:

This manual is edited separately to provide instructions for FRD. It consists of nine sections and an appendix. For items not covered herein, refer to the instruction manual for the standard roving machine.

Especially for matters related to safety, please first read Section S of FL200 instruction manual.

As to the contents of the items described in both of the two above-said manuals, give priority to this FRD manual.

Specifications, operating instructions, and dimensions in this manual are subject to change for improvements without prior notice.

TOYOTA shall take no responsibility for loss, damage, expense or claims for bodily injury or property damage arising from incorrect usage which is not in accordance with the instructions given in this manual.

In no event will TOYOTA be liable for products resulting from the use of this machine.

OCTOBER, 2011 Ver. 1.01

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S. SAFE WORK

S.1 Rules for Installation

S.1.1 Handling Heavy Components

When handling heavy components as given below, work in a comfortable position. If the weight exceeds 20 kg, two or more workers should handle it.

> Carrier frames, carrier weights, angle brackets, carrier motors, lifter pillars, top housings, lifter motors & their speed reduction gears, and balance weights

S.1.2 Handling Long Parts

(1) Long parts should be placed so that they will not fall. If necessary, provide anti-slipping measures or protective fences.

(2) Pay attention to the surroundings when handling long parts as given below. If one person is not enough, have several workers handle them.

> Carrier rails & racks, channels, carrier shafts, fork shafts, creel pillars, lifter shafts, lifter joints, carrier weights, angle brackets, and lifter pillars

S.1.3 Working in Low Positions

(1) In working with adjustment bolts in a low position, be careful when standing up so as not to drop straight-edges and parallel rulers which may cause injury.

(2) When installing carrier rails and racks, be careful with the flyer rails to prevent your head from getting injured.

S.1.4 Assembly and Adjustment

(1) Installing carrier rails and racks

1) During installation, watch your step not to stumble over carrier rails, racks, or pits.

2) Before starting installation jobs, be sure to move up the bobbin rail to the uppermost position with the handle.

3) In working in a low position, be careful with the bobbin rail when standing up to prevent your head from getting injured.

(2) Installing carriers

1) For installation jobs of frames and angle brackets, have two workers or more handle them since those components are heavy. During those jobs, communicate with co-workers and take care not to slip them out from hands.

2) Installation work to be done between the front of the FL and the carrier frame of the FRD involves many jobs in low and medium positions in a small working space, so be careful to prevent your head, upper body and hands from getting injured.

3) For installation jobs of carrier weights, have two workers or more handle them since those weights are heavy. During those jobs, communicate with co-workers and take care not to slip them out from hands.

(3) Installing lifters

1) For installation jobs of lifters, have two workers or more handle them since those components are heavy and long. During those jobs, communicate with co-workers and take care not to slip them out from hands. After installing them to pillar feet, temporarily secure them to prevent falling over.

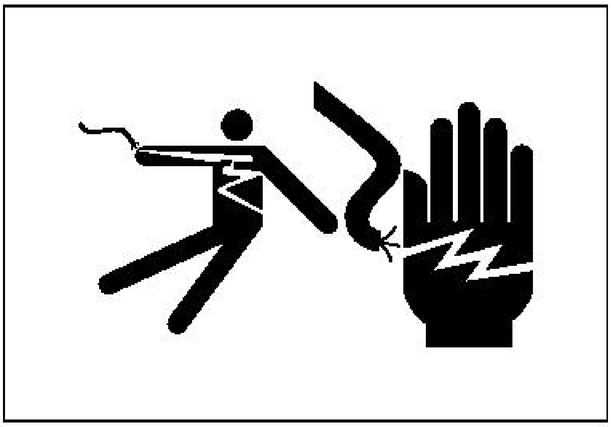
2) Installing top housings and lifter chains requires you to work at a high place, so use a stable, sturdy stool.

3) When installing heavy or long components such as arm brackets, arm joints, and lifter arms to the slides, apply mechanical stoppers to the rollers of the slides.

4) When installing motors and speed reduction gears to pillars, apply mechanical stoppers to the rollers of the slides.

5) For installation jobs of balance weights to lifter belts, have two workers or more handle them since those components are heavy. Move up lifters to the uppermost position and work at a low place.

6) For installation jobs of hanger rails to lifter arms, have two workers or more handle them and apply mechanical stoppers to the rollers of slides.



(4) Wiring

1) Never allow non-qualified workers to carry out connection or disconnection of the primary power lines.

2) Before starting wiring work, be sure to check that the main circuit breaker is open and the warning notice (tag) is put up for all to see.

3) Before starting wiring work, use a spark-testing screwdriver to check that the lines are not alive.

S.2 Rules before Trial Running

S.2.1 Area Around the FRD

(1) Clear away bolts, nuts, tools and other unnecessary things around the FRD.

(2) Check that all sections of the FRD are securely tightened and that the lifter covers are on.

S.2.2 Electrical Components

(1) See that the grounding wires in the control box are connected correctly.

(2) Check the routing, connection, and insulation of the wiring.

(3) Check the rotating direction for: carrier motors, fork motors, and lifter motors.

(4) Check the functions of each of the stop motions and limit switches.

S.3 Rules for Trial Running

(1) Rotate the drive belts and chains on each of the drive sections manually to check for fraying, breaks or other damage. Make sure to communicate with co-workers so that no one's hand becomes caught in running belts or chains.

(2) When starting the FRD, communicate your intention to co-workers, and wait for them to confirm it. Then, check that the FRD starts and stops normally.

(3) When meshing drive gears, take care not to let your hands slip due to oil.

(4) Checking engagement between lifter belts and lifter chain gears requires you to work at a high place, so use a stable, sturdy stool.

S.4 Safety System

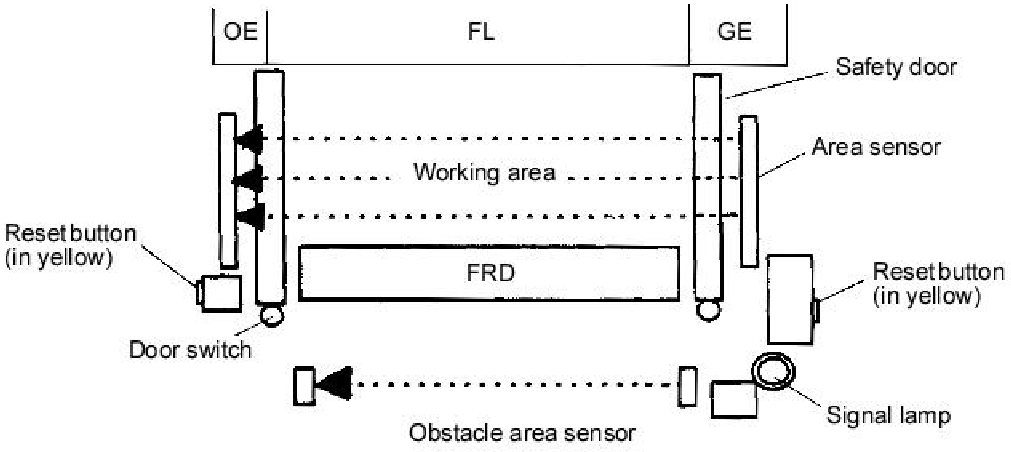
S.4.1 Configuration of the Safety System

The safety system consists of safety doors and an area sensor that are located at the GE and OE, and an obstacle area sensor located at the rear of the FRD.

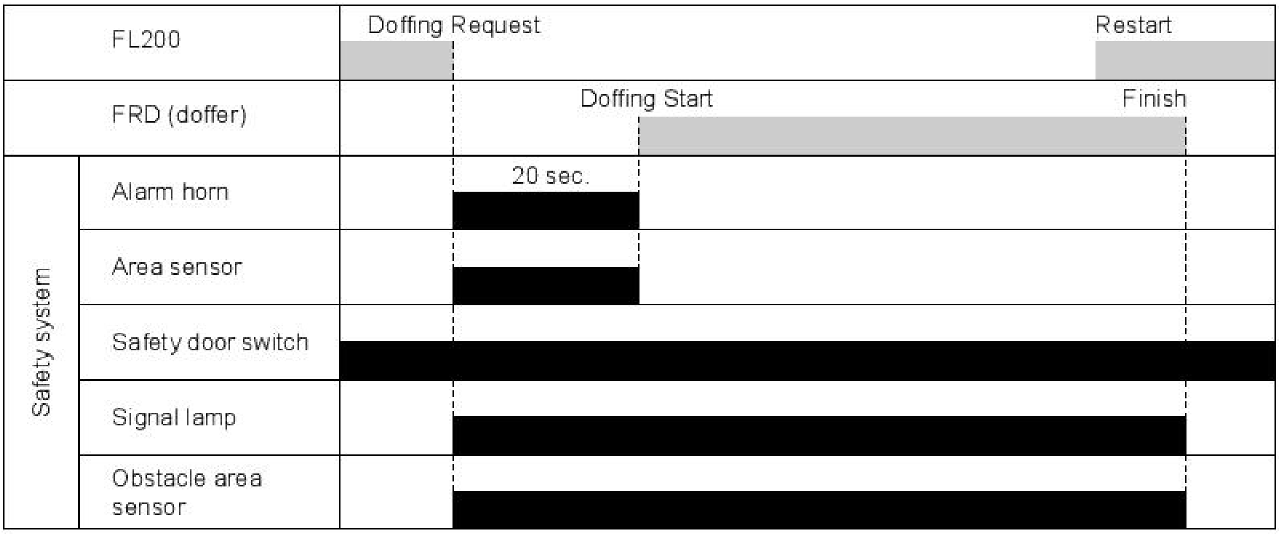
The safety system detects whether anyone is present in the working area. It disables the FRD until all persons in the working area go out of the area and the safety system gets reset.

Mounted on the lifter pillar at the GE, the signal lamp shows the FRD operating status with the lamp color.

Before the start of FRD automatic operation, the signal lamp lights and an alarm horn sounds.


OE
FL
GE
Safety door
Area sensor
Working area
Reset button (in yellow)
FRD
Reset button (in yellow)
Door switch
Signal lamp
Obstacle area sensor

S.4.2 Operation Timing and Period of the Safety System

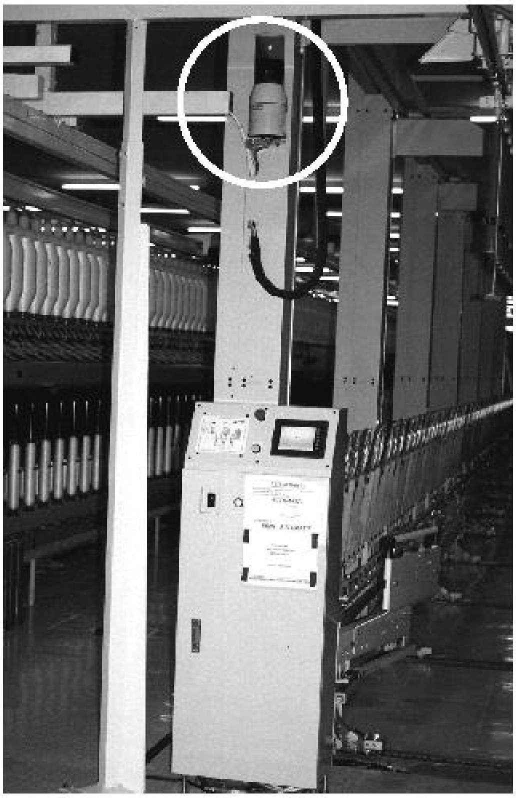


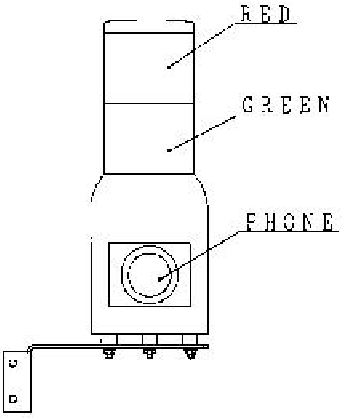
NOTE: If an alarm horn sounds, immediately go out of the working area.

S.4.3 Resetting Procedure

Safety system	Resetting procedure
Area sensor	Press the reset button on the FRD's operating panel.
Door switch	Press the yellow reset button on the control box.
Obstacle area sensor	Press the reset button on the FRD's operating panel.

NOTE: Be sure to confirm that there is no one in the working area before performing reset operation or starting the FRD.





Signal lamp

S.4.4 Signal Lamp

The signal lamp consists of a revolving flasher and alarm horn. The horn sounds for approx. 20 seconds before the start of FRD automatic operation.

(1) Signal lamp color and FRD status
If the signal lamp lights in green, it means that the FRD is in operation.
If it lights in red, it means: 1) any problem has occurred with the FRD, 2) the emergency stop button has been pressed, or 3) either of the safety doors is opened when the FRD is in operation or doffing the FL200.

(2) To turn off the red signal lamp

1) Check the message displayed on the FRD operating panel and take any necessary action.

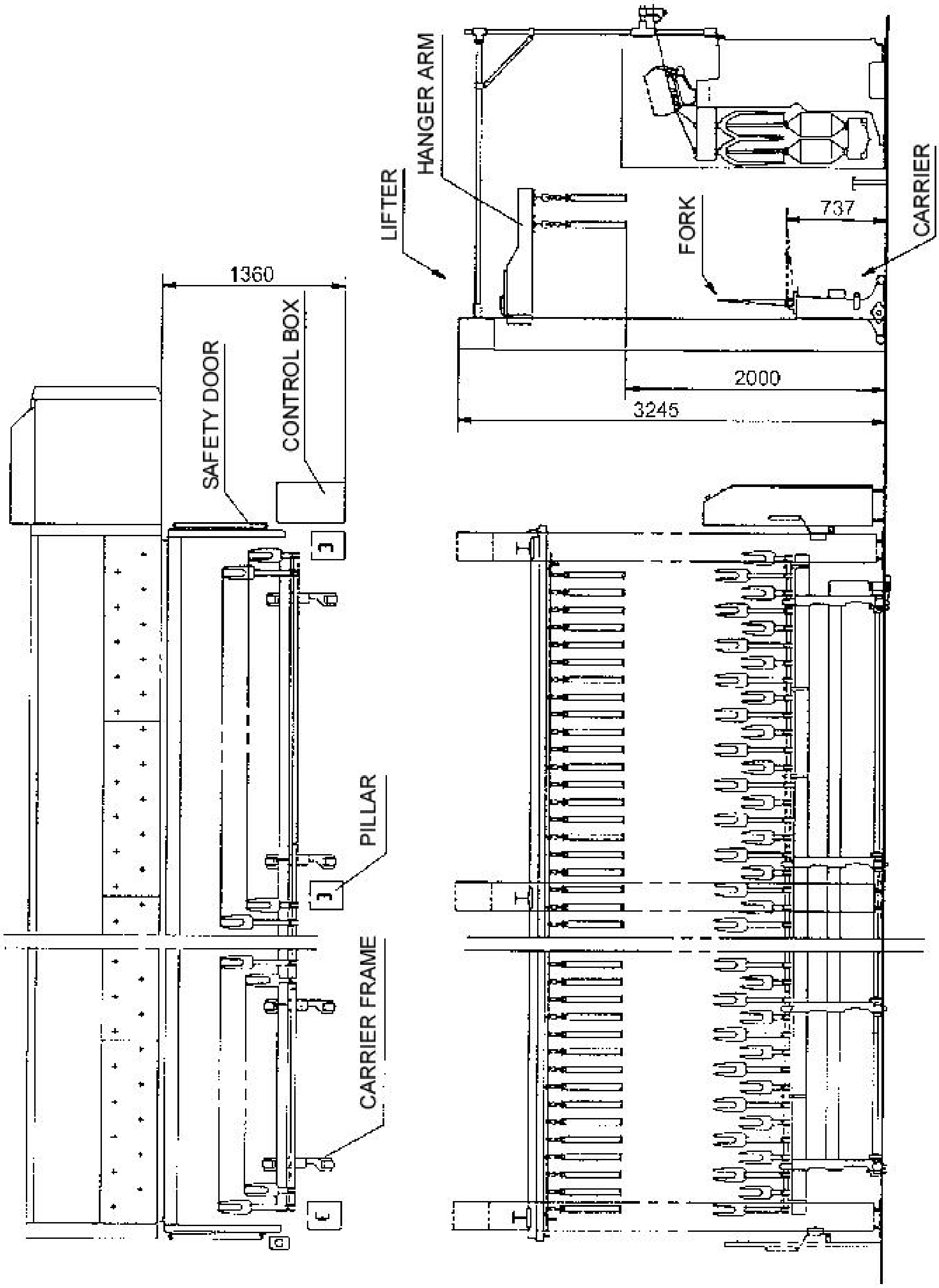
2) If the emergency stop button has been pressed, reset the button and then perform the FRD reset operation on the FRD operation panel.

3) If either of the safety doors is opened, confirm that there is no one in the working area, close the door(s), and press the yellow reset button on the control box.

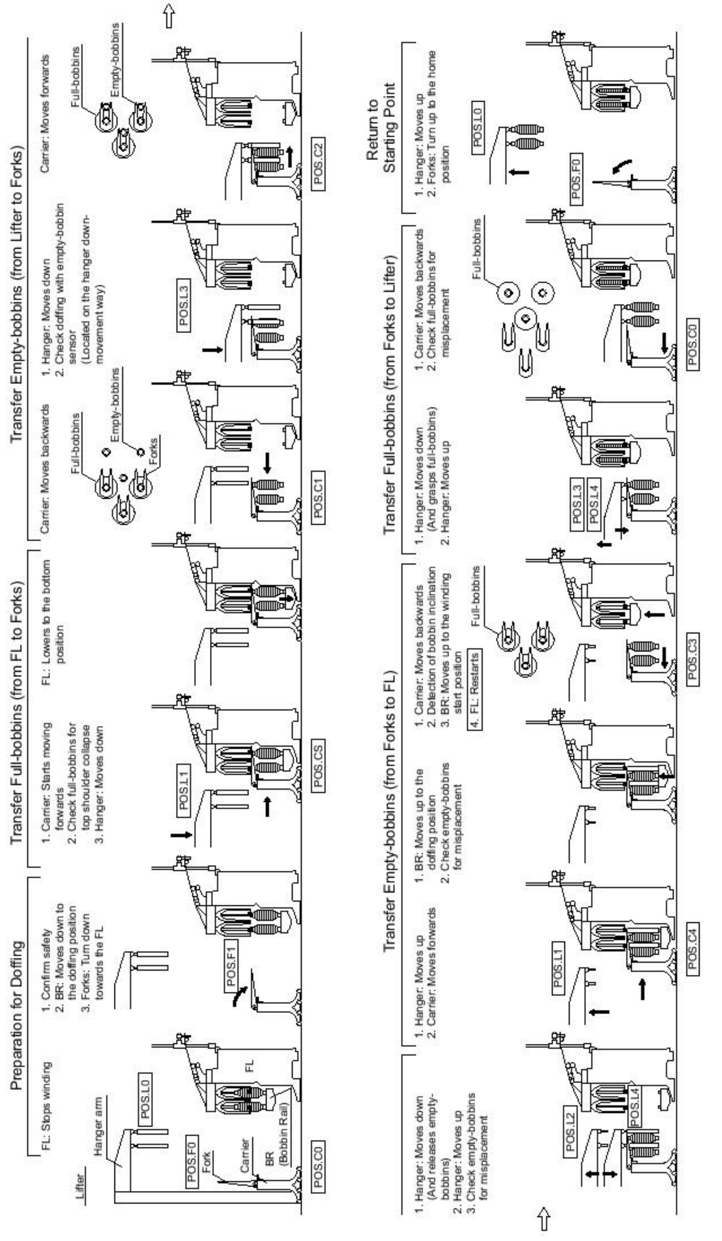
1. OUTLINE

1.1 Configuration of the FRD

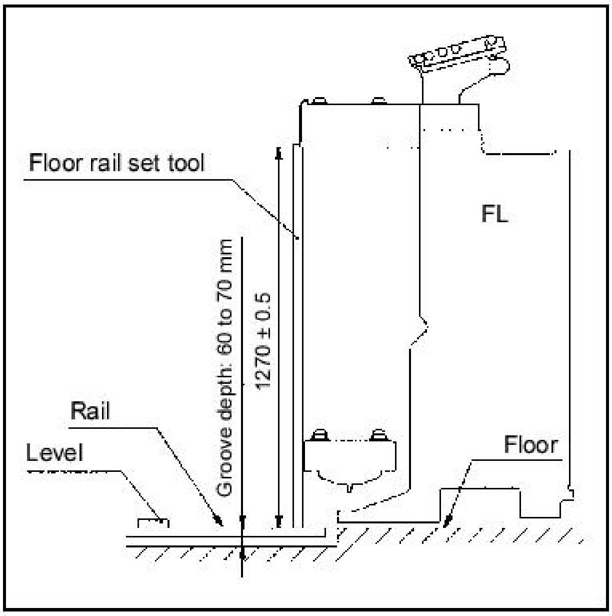
The FRD is an automatic stationary roving package doffer for roving frame FL which is capable of changing bobbins all at once. It consists of a carrier and lifter; the former changes bobbins on the roving frame and the latter changes them on the carrier.


HANGER ARM
LIFTER
FORK
737
CARRIER
1360
SAFETY DOOR
CONTROL BOX
2000
3245
PILLAR
CARRIER FRAME

1.2 Operating Sequence of the FRD


Preparation for Doffing
FL: Stops winding
1. Confirm safety
2. BR: Moves down to the doffing position
3. Forks: Turn down towards the FL
Transfer Full-bobbins (from FL to Forks)
1. Carrier: Starts moving forwards
2. Check full-bobbins for top shoulder collapse
3. Hanger: Moves down
FL: Lowers to the bottom position
Transfer Empty-bobbins (from Lifter to Forks)
Carrier: Moves backwards
1. Hanger: Moves down
2. Check doffing with empty-bobbin sensor (Located on the hanger down-movement way)
Carrier: Moves forwards
Lifter
Hanger arm
POS.L0
POS.F0
Fork
Carrier
BR (Bobbin Rail)
FL
POS.F1
POS.L1
POS.L3
Full-bobbins
Empty-bobbins
Forks
POS.C0
POS.CS
POS.C1
POS.C2
⇨
Transfer Empty-bobbins (from Forks to FL)
1. Hanger: Moves down (And releases empty-bobbins)
2. Hanger: Moves up
3. Check empty-bobbins for misplacement
1. Hanger: Moves up
2. Carrier: Moves forwards
1. BR: Moves up to the doffing position
2. Check empty-bobbins for misplacement
1. Carrier: Moves backwards
2. Detection of bobbin inclination
3. BR: Moves up to the winding start position
4. FL: Restarts
Transfer Full-bobbins (from Forks to Lifter)
1. Hanger: Moves down (And grasps full-bobbins)
2. Hanger: Moves up
1. Carrier: Moves backwards
2. Check full-bobbins for misplacement
Return to Starting Point
1. Hanger: Moves up
2. Forks: Turn up to the home position
POS.L2
POS.L4
POS.L1
POS.L3
POS.L4
POS.F0
POS.L0
Full-bobbins
POS.C4
POS.C3
POS.C0

2. INSTALLATION


Floor rail set tool
FL
Groove depth: 60 to 70 mm
1270 ± 0.5
Rail
Level
Floor

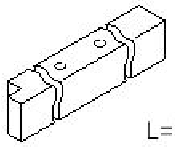
2.1 Carrier Rail

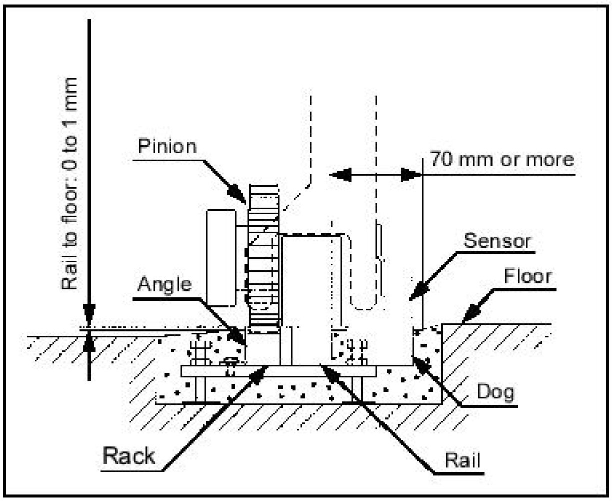
(1) Pit for carrier rail

The pit for installing the carrier rail should be 60 mm to 70 mm deep from the floor datum level.

(2) Installing carrier rail

Use the floor rail set tool (F7801-50010-00) and a level to adjust the carrier rail position according to the marked lines so that the dimension from the top surface of the carrier rail to the lower surface of the flyer rail will be 1270 ± 0.5 mm.

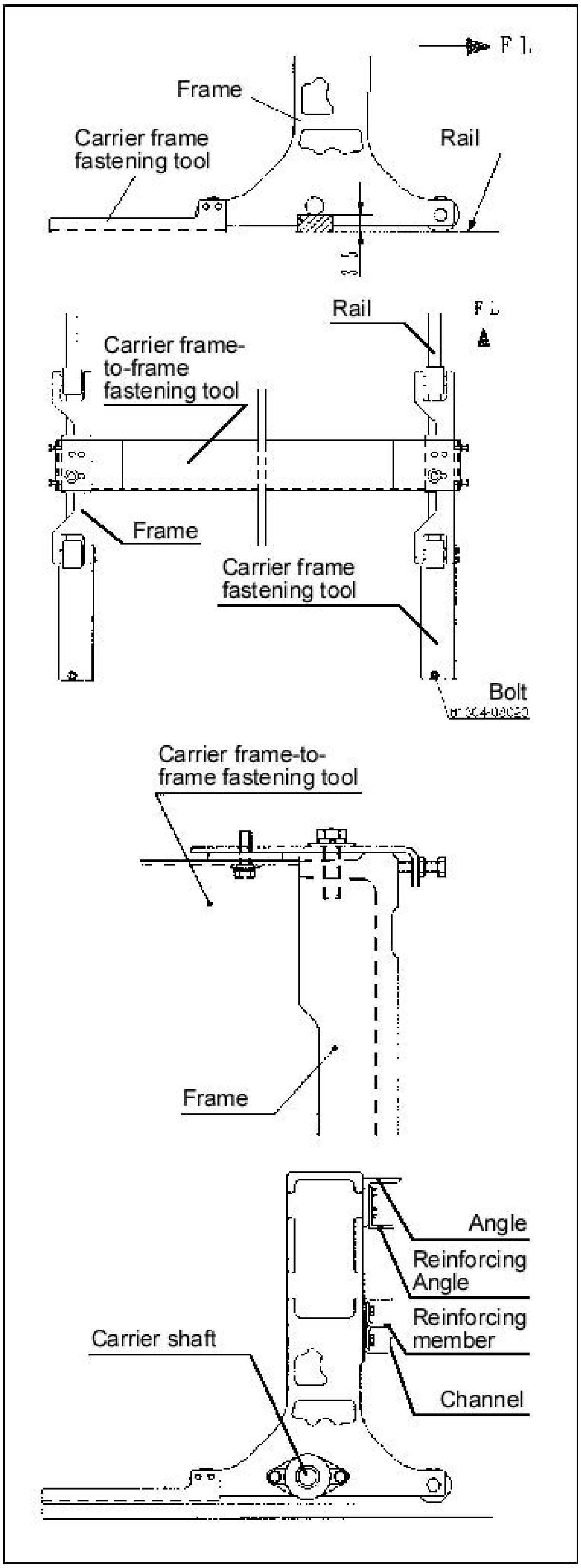
	1	F7801-50010-00


Rail to floor: 0 to 1 mm
Pinion
70 mm or more
Sensor
Angle
Floor
Dog
Rack
Rail

(3) Burying carrier pit

- Bury the pit with mortar after adjusting the carrier position (3.3.10).
- The mortared floor surface shall be 0 to 1 mm lower than the carrier rail and the rack top surface to prevent the roller and sensor, etc. from making contact with the floor surface.

NOTE: Don't leave excess mortar or concrete pieces on the carrier rail, rack and/or dog.

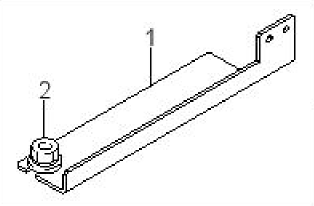

F L
Frame
Carrier frame fastening tool
Rail
3.5
Rail
F L
Carrier frame-to-frame fastening tool
Frame
Carrier frame fastening tool
Bolt
81304-08020
Carrier frame-to-frame fastening tool
Frame
Angle
Reinforcing Angle
Reinforcing member
Carrier shaft
Channel

2.2 Assembling Carrier

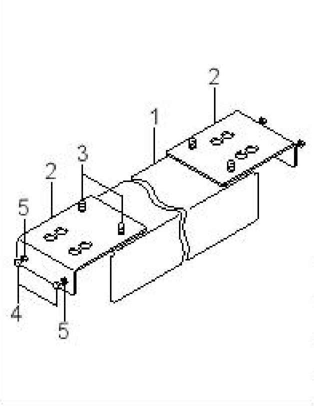
2.2.1 Frame

(1) Arrange a frame, channel, angle, reinforcing angle and carrier shaft on the floor in front of the **FL**.

(2) Set the frame on the rail from the drive block in the G.E. and fasten using the carrier frame-fastening tool (F7801-18010-00). Don't remove the carrier frame-fastening tool until the fork shaft is aligned.

	1	F7801-18010-00
	2	81304-08020

(3) Use the carrier frame to frame fastening tools (F7801-100*0-00 & F7801-11010-00) to set the frame-to-frame distance.

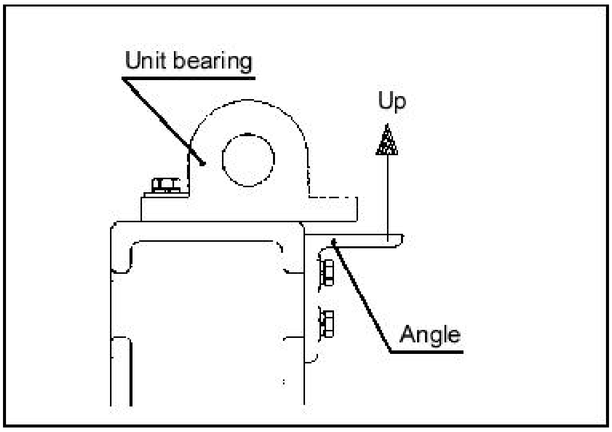
	1	F7801-10010-00 F7801-10020-00 F7801-10030-00 F7801-10040-00 F7801-10050-00 F7801-10060-00 F7801-10070-00
	5	F7801-11010-00
	3	81304-08020
	4	81201-08040
	5	84102-00800

(4) After positioning the frame, temporarily mount the channel, angle and member to the frame except the angle.

(5) Place the pinioned carrier shaft through the frame and temporarily install the unit bearing.

(6) Remove the carrier frame-fastening tool.

(7) Proceed to the following block (frame to frame).



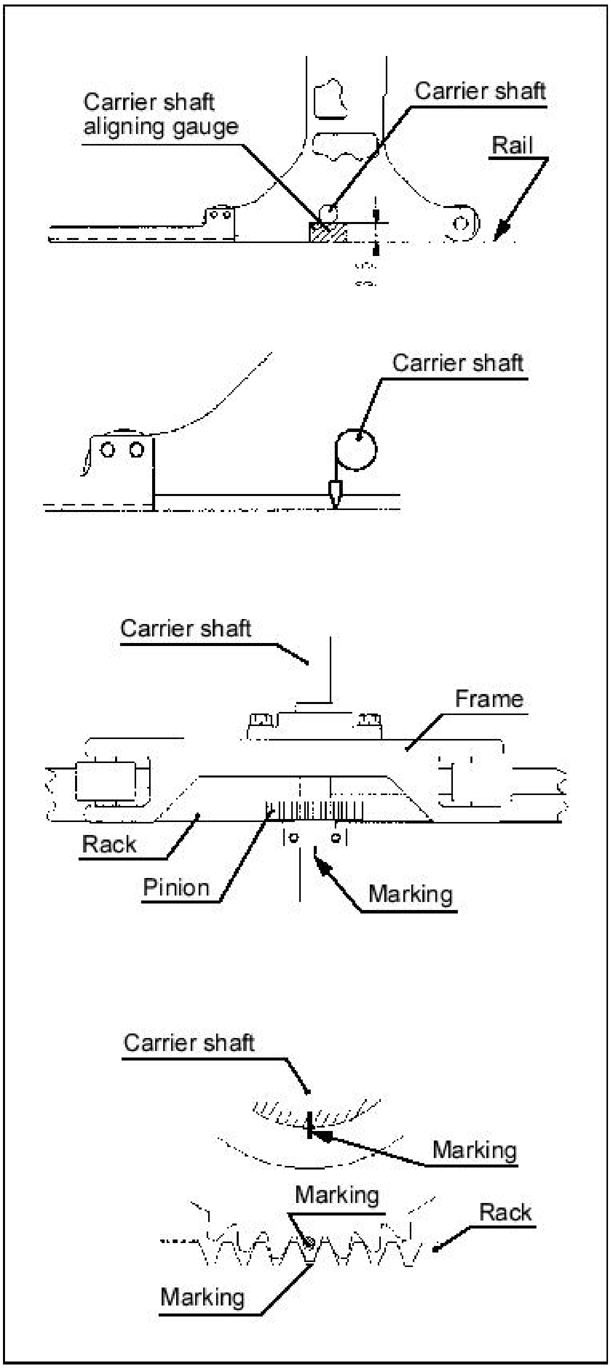
2.2.2 Angle

(1) Mount the unit bearing for the fork shaft to the frame.

(2) Hold the angle until it makes contact with the unit bearing and fasten the angle to the frame.

(3) Remove the unit bearing. Apply the unit bearing in turn for each frame.

(4) After the end of angle installation, install the reinforcing angle by aligning the hole positions.

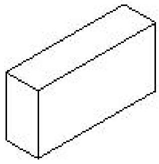

Carrier shaft aligning gauge
Carrier shaft
Rail
Carrier shaft
Carrier shaft
Frame
Rack
Pinion
Marking
Carrier shaft
Marking
Marking
Rack
Marking

2.2.3 Aligning Carrier Shaft

NOTE: Shift the pinion from the rack. Align the carrier shaft from GE.

(1) Loosen the bolt of the unit bearing.

(2) Place the carrier shaft aligning gauge (F7801-19010-00) between the carrier shaft and the rail to determine the carrier shaft height.

	1	F7801-19010-00

(3) Use a bob weight to adjust the carrier shaft position to coincide with the marked line.

(4) Fasten the unit bearing to the frame.

2.2.4 Pinion

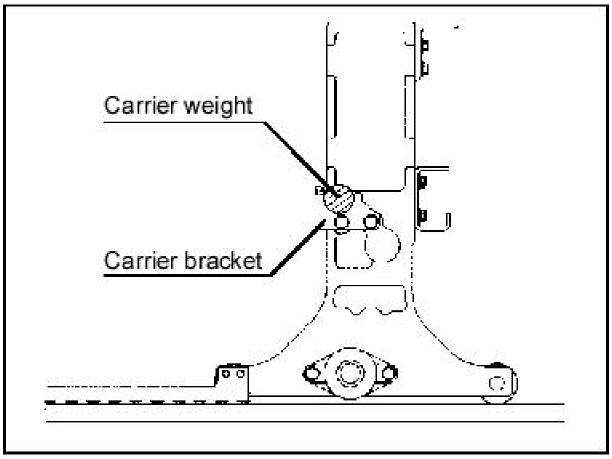
(1) Engage the pinion that has been shifted to the carrier shaft to the rack.

NOTE: After completing the assembly, mark the carrier shaft and pinion, and the pinion and rack.

2.2.5 Carrier Weight

(1) Fasten the weight bracket to the frame.

(2) Place the carrier weight on the weight bracket and fasten.


Carrier weight
Carrier bracket

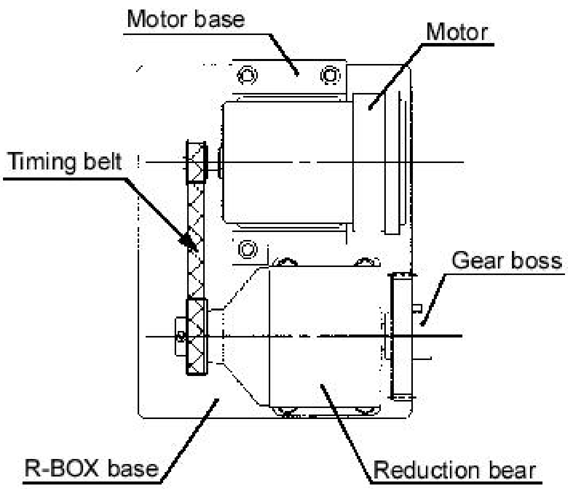
2.2.6 Carrier Motor

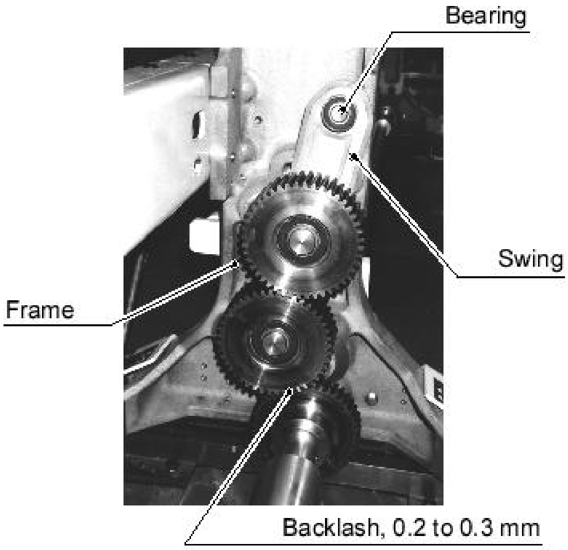
(1) Install the motor and reduction gear to the R-BOX base and set the timing belt.

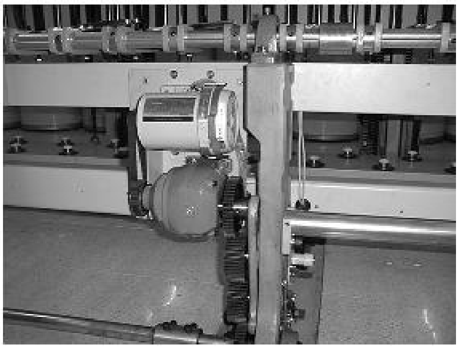
(2) Temporarily install the swing to the frame.

(3) Insert the gear boss of reduction gear to the swing bearing. Fasten the motor base to the angle and channel.

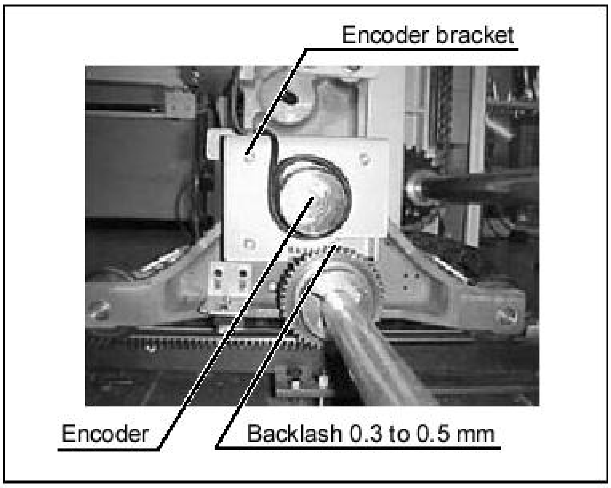
(4) Move the swing to adjust backlash (0.2 to 0.3 mm). After adjustment, fasten the swing to the frame.


Motor base
Motor
Timing belt
Gear boss
R-BOX base
Reduction bear


Bearing
Swing
Frame
Backlash, 0.2 to 0.3 mm



2.2.7 Rotary Encoder

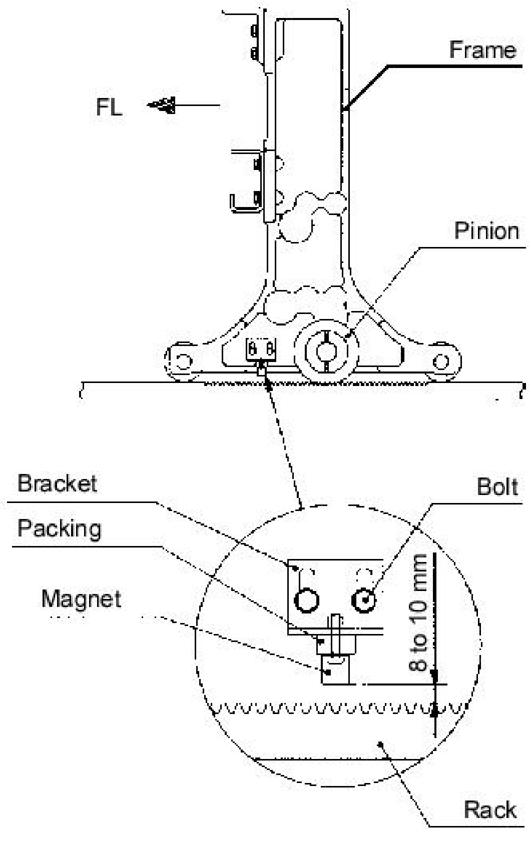

Encoder bracket
Encoder
Backlash 0.3 to 0.5 mm

NOTE: Since the rotary encoder is an important component to control the carrier operation, care should be taken when handling it.

(1) Temporarily assemble the encoder and the encoder bracket to the GE frame.

(2) Adjust the backlash to 0.3 to 0.5 mm and fasten the encoder bracket to the frame.

2.2.8 Metal Removing Magnet


Frame
FL
Pinion
Bracket
Bolt
Packing
Magnet
8 to 10 mm
Rack

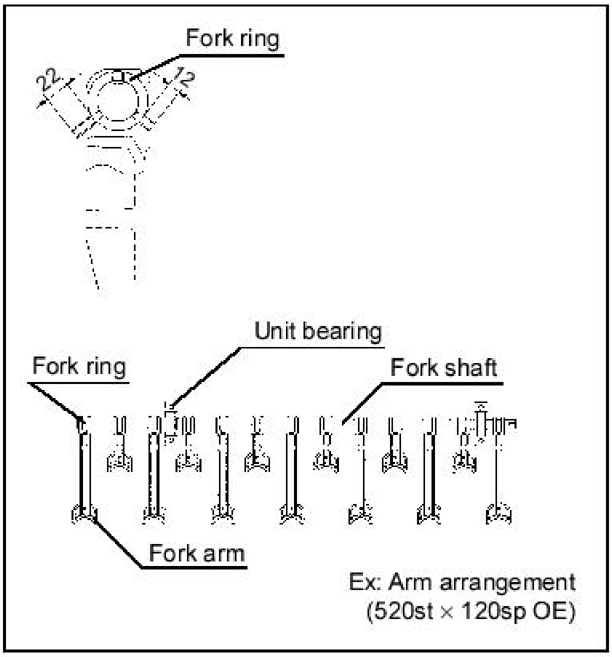
- The metal removing magnet is a device to remove metal pieces and bolts, etc. on the rack.
- This device is installed to the frame with a rack.

NOTE: Since the effect of magnetic force is limlted, remove periodically metal pieces and bolts attracted to the magnet.

(1) Install a packing and magnet to the magnet bracket. Don't press the packing, however.

(2) Provide a clearance of 8 to 10 mm between the magnet and the rack.

2.2.9 Fork Shaft


Fork ring
22
12
Unit bearing
Fork ring
Fork shaft
Fork arm
Ex: Arm arrangement
(520st × 120sp OE)

(1) Insert the fork shaft to the unit bearing, fork arm and fork ring.

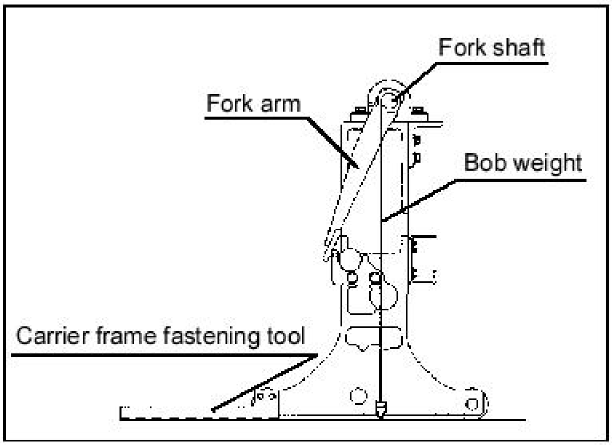
NOTE: When placing the fork shaft through the fork ring, care should be taken for the direction.

(2) To prevent the parts from falling from the fork shaft during transportation for assembly, temporarily fasten the fork ring or unit bearing at the ends of the fork shaft.

(3) After sub-assembly, place the fork shaft on to the frame and angle from OE, and temporarily assemble with the unit bearing. Keep the arm down behind the frame.

(4) Joint fork shafts sequentially by coupling.

2.2.10 Aligning Fork Shaft

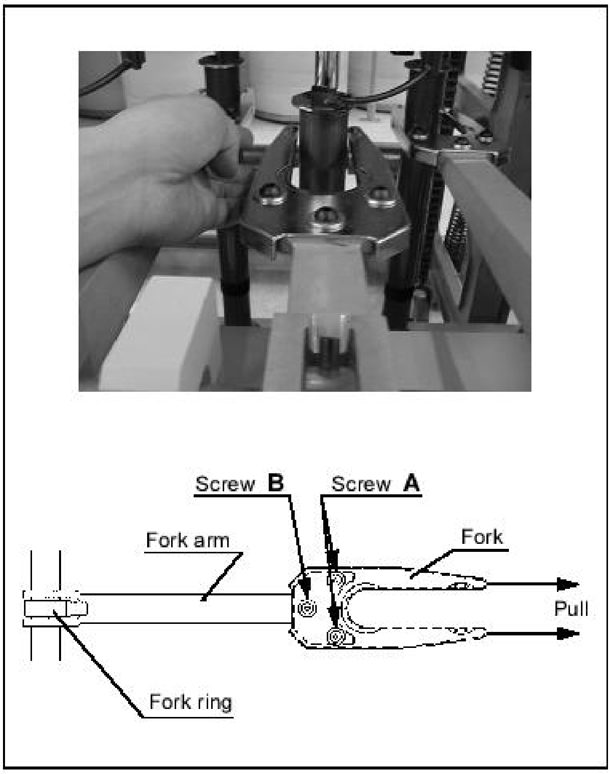

Fork shaft
Fork arm
Bob weight
Carrier frame fastening tool

(1) Use the bob weight to adjust the fork shaft position to coincide with the marked line.

(2) Fasten the unit bearing to the frame.

(3) After completing alignment, remove the carrier frame-fastening tool.

2.2.11 Adjusting Longitudinal Position of Fork



(1) Install the adjust screw to the angle so that the fork will tilt downward slightly than the level position.

(2) Install the fork to the arm.

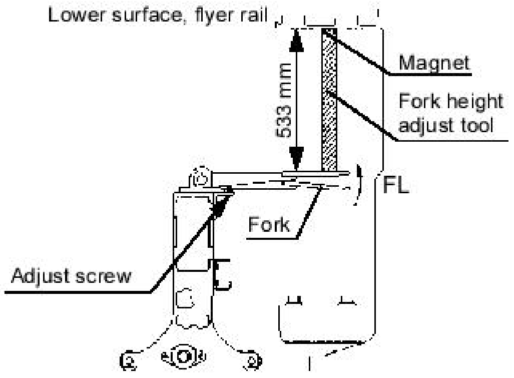
NOTE: Press the fork toward FL, tighten screw **A** then screw **B**.

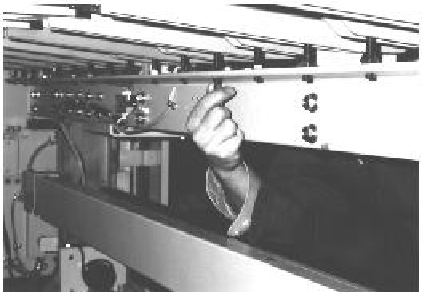
(3) Load an empty bobbin to the bobbin wheel and raise the rail to near the full bobbin withdrawal position.

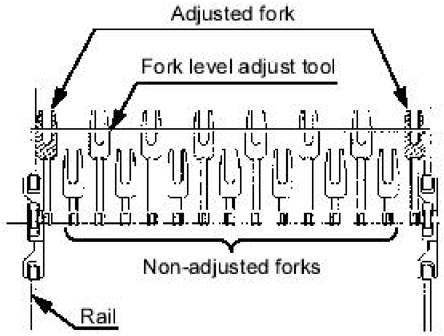
(4) Move the carrier by operating the handle until the bobbin is inserted to the fork (see 4.3).

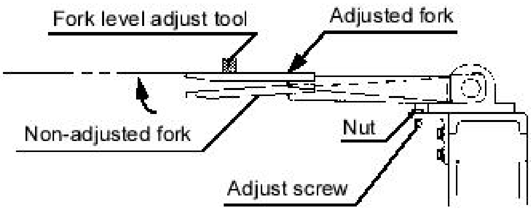
(5) Tighten the setscrew on the fork ring at a position where the fork and the bobbin make no contact with each other when the arm is moved up and down.

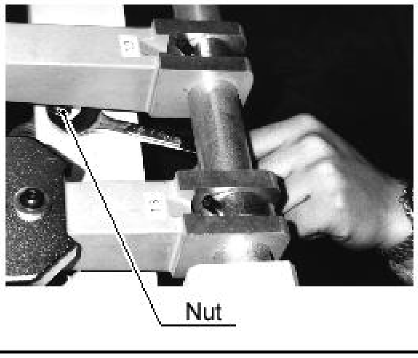
2.2.12 Adjusting Height Position of Fork


Lower surface, flyer rail
533 mm
Magnet
Fork height adjust tool
FL
Fork
Adjust screw



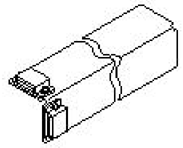

Adjusted fork
Fork level adjust tool
Non-adjusted forks
Rail


Fork level adjust tool
Adjusted fork
Non-adjusted fork
Nut
Adjust screw

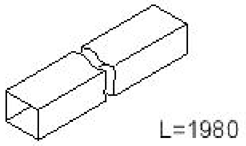


Adjust the height of the fork for each block (between frames).

Use the fork height adjust tool (F7801-34010-00) for adjusting the fork height at the ends of a block.

	1	F7801-34010-00

Use the fork level adjust tool (F7801-31010-00) for adjusting the fork height between the frames.

	1	F7801-31010-00

(1) Install the fork height adjust tool to the lower surface of the flyer rail.

(2) Fasten the adjust tool using the adjust screw so that the upper surface of the fork will be in contact with the fork height adjust tool.

Distance between the fork upper surface and the flyer rail lower surface: 533 mm

(3) Place the fork level adjust tool on the upper surface of the adjusted fork.

Make sure that no clearance exists between the fork level adjust tool and the upper surface of the adjusted fork.

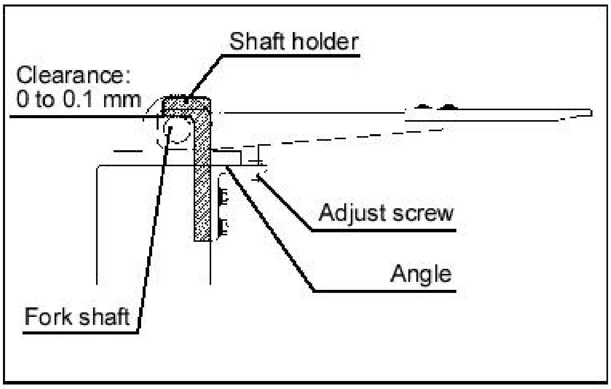
If any clearance should exist, loosen the adjust screw and lower the non-adjusted fork slightly.

(4) Tighten the adjust screw and eliminate the clearance between the non-adjusted fork and the fork level adjust tool.

(5) After the adjustment, make sure again that no clearance exists between the fork and the fork level adjust tool.

Then tighten the nut on the adjust screw to fasten the fork.

2.2.13 Shaft Holder


Shaft holder
Clearance:
0 to 0.1 mm
Adjust screw
Angle
Fork shaft

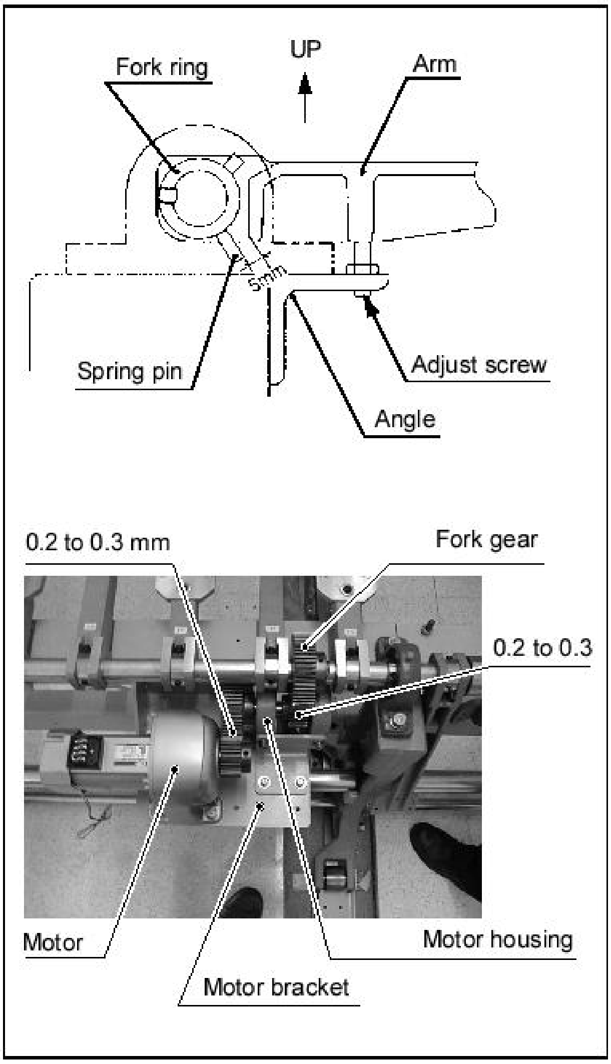
Shaft holder is a bracket to prevent the fork shaft from deflecting when the fork is loaded with a full bobbin.

(1) Level the fork.

(2) Hook the shaft holder on to the fork shaft.

(3) Fasten the shaft holder to the angle lightly in contact with the fork shaft.

2.2.14 Fork Motor


Fork ring
UP
Arm
5mm
Spring pin
Adjust screw
Angle
0.2 to 0.3 mm
Fork gear
0.2 to 0.3
Motor
Motor housing
Motor bracket

NOTE: When assembling the gear, set the shaft so that clearance will exist between the spring pin and the arm (see 3.3.13).

(1) Temporarily install the bearing housing to the angle.

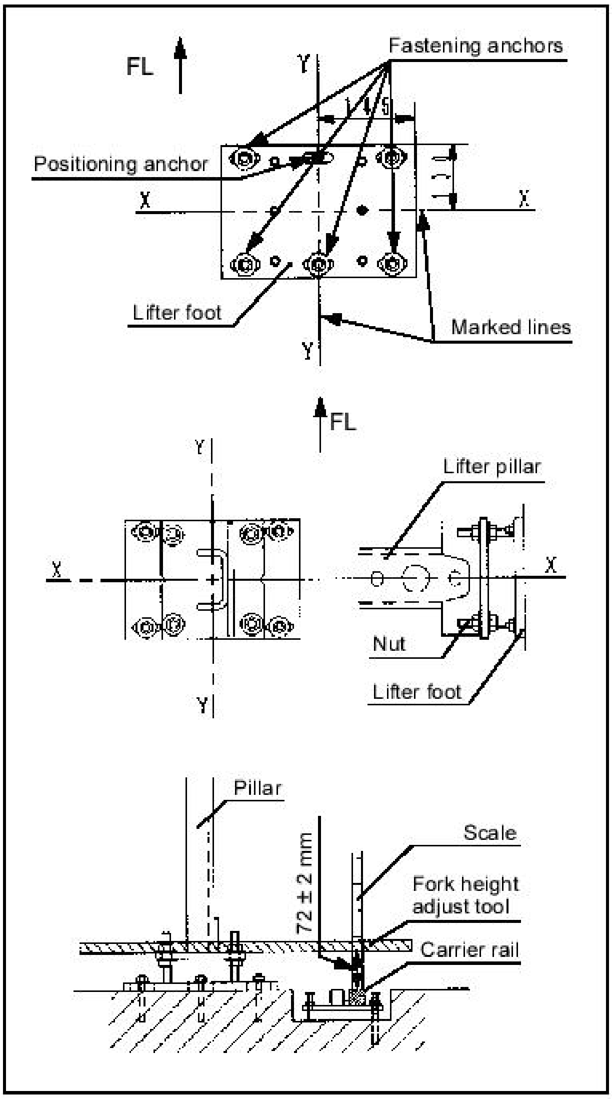
(2) Install the motor bracket to the angle.

(3) Temporarily install the motor to the motor bracket.

(4) Adjust both backlashes between the fork gear and the bearing housing gear, and the motor and the bearing housing gear to 0.2 to 0.3 mm and fasten the bearing housing and the motor.

2.3 Assembling Lifter

NOTE: When assembling the lifter, arrange for a stepladder (about 1800 mm).


FL
Y
Fastening anchors
Positioning anchor
X
X
Lifter foot
Marked lines
Y
FL
Y
Lifter pillar
X
X
Nut
Lifter foot
Y
Pillar
Scale
72 ± 2 mm
Fork height adjust tool
Carrier rail

2.3.1 Lifter Foot

(1) Provide the foot with the marking for matching with the marked line **X**, **Y**.

(2) Hold the lifter foot by matching to the marked line and strike the fastening anchor to the center of the foot and in the slotted hole on the FL side.

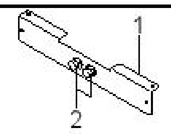
(3) Strike the fastening anchors to the remaining slotted holes.

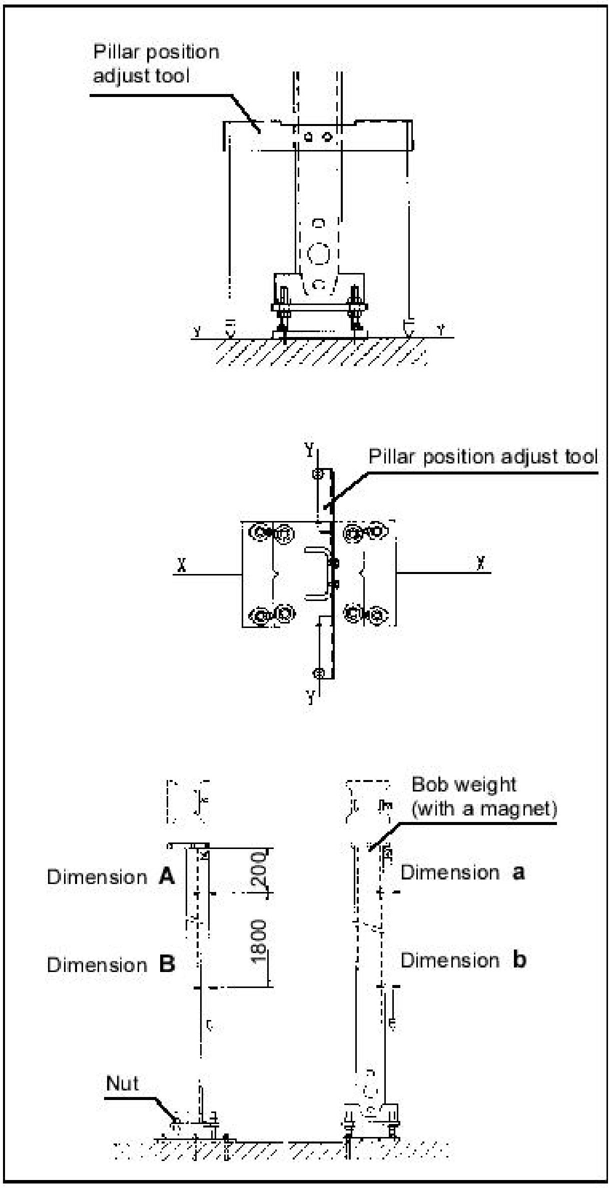
2.3.2 Lifter Pillar

(1) Erect the lifter pillar on the lifter foot, match it in **Y** direction and tighten temporarily with a nut.

(2) Lifter pillar height adjustment

1) Place a tool (use the fork height adjust tool) on the top surface of the lifter pillar flange. Adjust the dimension between the pillar flange top surface and the carrier rail to 72 ± 2 mm.

	1	F7801-61010-00
	2	81304-08020


Pillar position adjust tool
Y
Y
Pillar position adjust tool
X
X
Y
Y
Bob weight (with a magnet)
Dimension A
200
Dimension a
1800
Dimension B
Dimension b
Nut

(3) Lifter pillar position adjustment

1) Install the pillar adjust tool (F7801-61010-00) to the lifter pillar and hang the bob weight.

2) Adjust the lifter pillar to match the bob weight to the marked line.

(4) Lifter pillar vertical adjustment

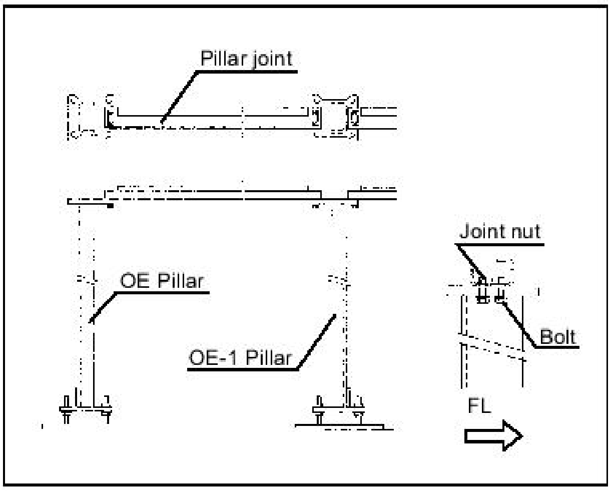
1) Hang each bob weight (with a magnet) to two surfaces on the upper section of the lifter pillar.

2) Measure dimensions **A**, **B** and **a**, **b** between the pillar and the bob weight string at positions about 200 mm and 2000 mm from the lower surface of the lifter pillar flange.

3) Adjust dimensions (**A** - **B**) and (**a** - **b**) to be within ±1.5 mm.

(5) After completing the pillar position adjustment, fasten the pillar with the nuts.

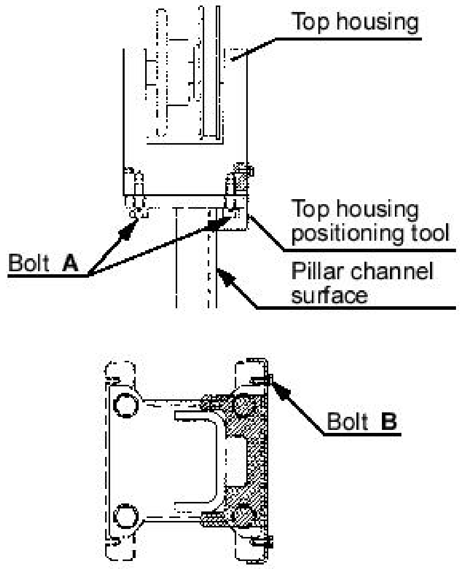
2.3.3 Pillar Joint


Pillar joint
OE Pillar
OE-1 Pillar
Joint nut
Bolt
FL

(1) Place the pillar joint on the top surface of the pillar flange.

(2) Placed the joint nut inside the pillar joint channel and fasten with the bolts.

NOTE: When tightening the bolts, don't tilt the pillar.

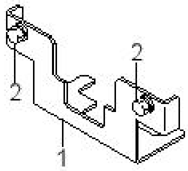

Top housing
Top housing positioning tool
Bolt A
Pillar channel surface
Bolt B

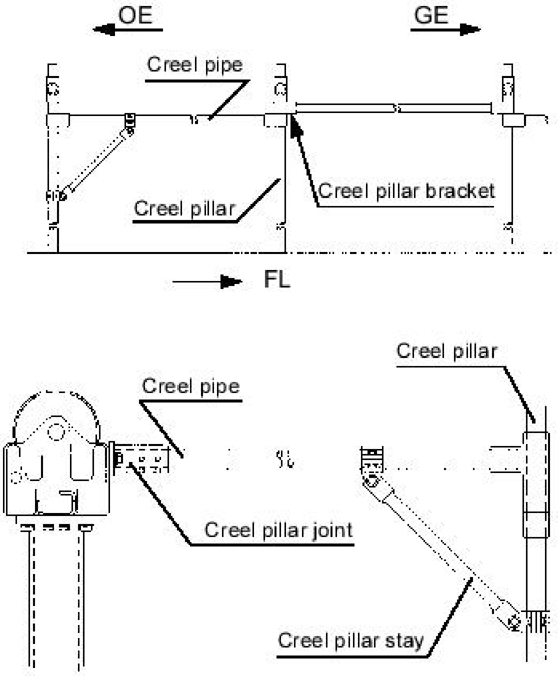
2.3.4 Top Housing

(1) Place the top housing on the top surface of the pillar flange and temporarily tighten with bolt **A**.

(2) Fix the top housing positioning tool (F7801-65010-00) to the top housing with bolt **B**.

(3) Hold the top housing positioning tool to the pillar channel surface and fix with bolt **A**.

	1	F7801-65010-00
	2	81303-06012


OE
GE
Creel pipe
Creel pillar
Creel pillar bracket
FL
Creel pillar
Creel pipe
Creel pillar joint
Creel pillar stay

2.3.5 Creel Pillar

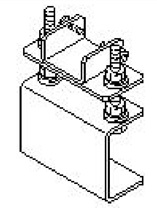
(1) Joint the creel pipes of the longitudinal direction of FL with the creel pillar bracket.

(2) Mount the creel pillar joint to the top housing and joint the lifter pillar and the creel pillar with the creel pipe.

(3) Install the creel pillar stay.

2.3.6 Aligning Lifter Shaft

- Make alignment from the OE side.
- Use two sets of lifter shaft height adjust tool (F7801-21010-00) for alignment. Use one set for determining (fixing) the height and another for adjusting (jacking) the height.

	1	F7801-21010-00

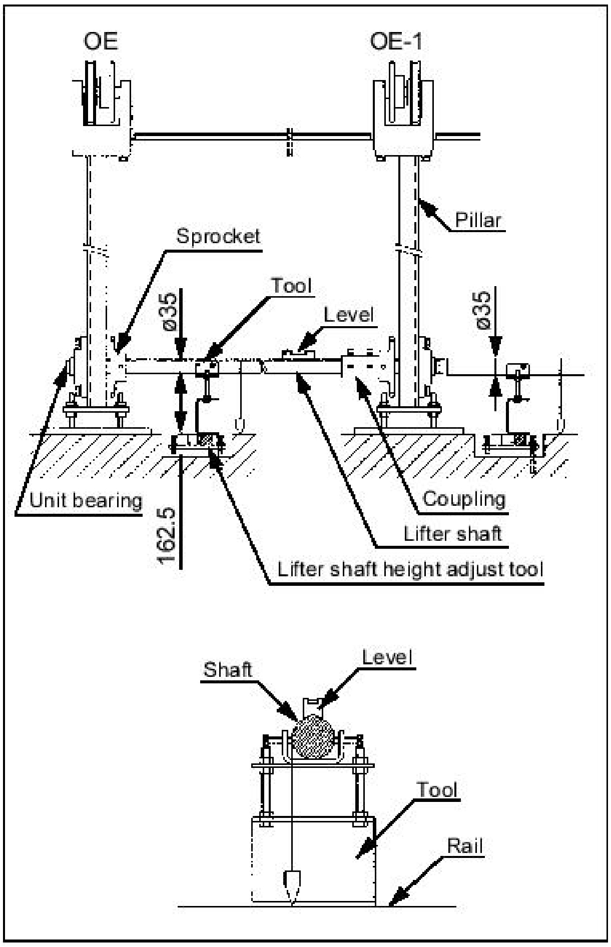
(1) Place the lifter shaft attached with the sprocket through the pillar from the OE side. Sequentially joint with the coupling and temporarily install with the unit bearing.

(2) Place the height determining tool on the top surface of the OE carrier rail. Support the following shaft with the height adjust tool.

NOTE: Before placing the tool on the carrier rail, adjust the height-determining tool so that the dimension between the OE carrier rail and the shaft lower surface will be 162.5 mm (dia. 35 section) .

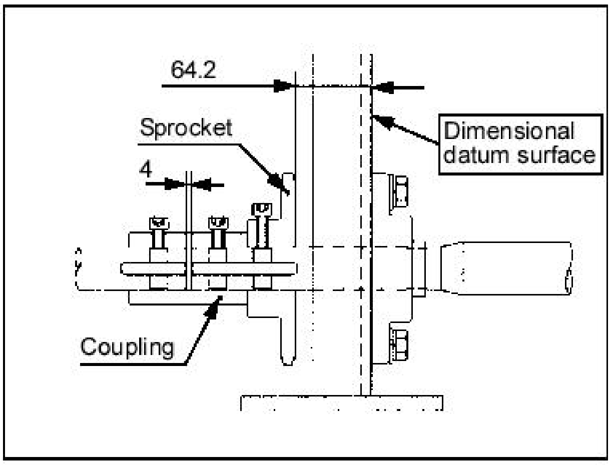
(3) Use the level and bob weight to adjust the height adjust tool and align the shaft.

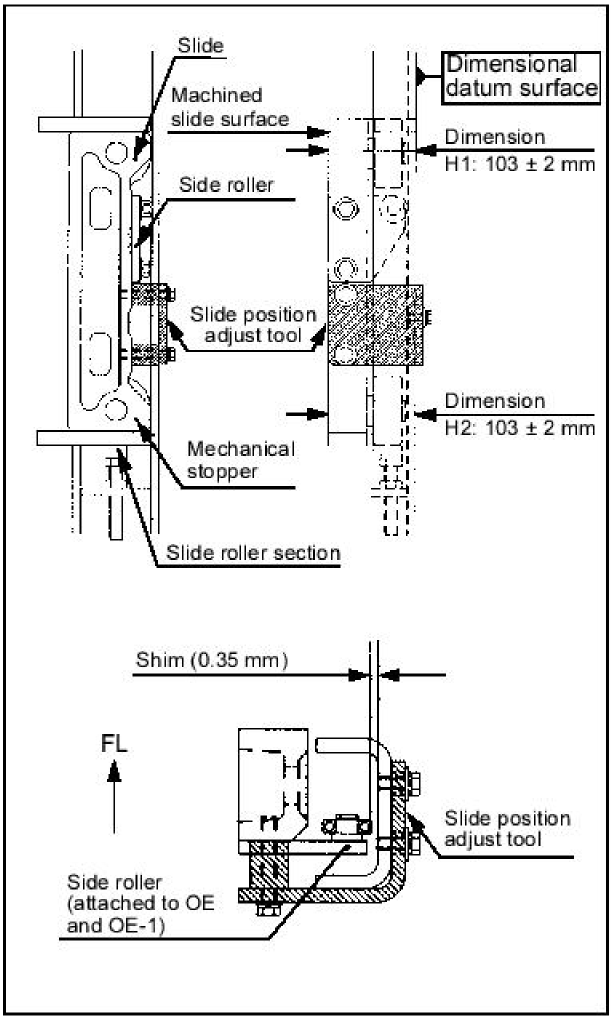
NOTE: After assembly, see the shaft rotates by hand with ease.


OE
OE-1
Pillar
Sprocket
Tool
Level
ø35
ø35
Unit bearing
Coupling
Lifter shaft
162.5
Lifter shaft height adjust tool
Shaft
Level
Tool
Rail

2.3.7 Sprocket

After aligning the lifter shaft, position the sprocket at 64.2 mm from the pillar position datum surface (channel surface) and fix.


64.2
Sprocket
4
Dimensional datum surface
Coupling


Slide
Machined slide surface
Side roller
Slide position adjust tool
Mechanical stopper
Slide roller section
Dimensional datum surface
Dimension H1: 103 ± 2 mm
Dimension H2: 103 ± 2 mm
Shim (0.35 mm)
FL
Side roller (attached to OE and OE-1)
Slide position adjust tool

2.3.8 Slide and Side Roller

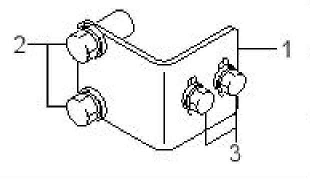
First assemble the slide for OE pillar and OE-1 pillar (second pillar from the OE).

Assemble the slide for other pillars sequentially after completing the installation of arm joint (see 2.3.11).

(1) Install the side roller to the slide.

NOTE: Install the side roller only to the slides of OE and OE-1 pillars.

(2) Use the slide position adjust tool to fix the slide to the pillar so that dimensions H1 and H2 between the machined surface of the slide and the dimensional datum surface of the pillar will be 103 ± 2 mm.

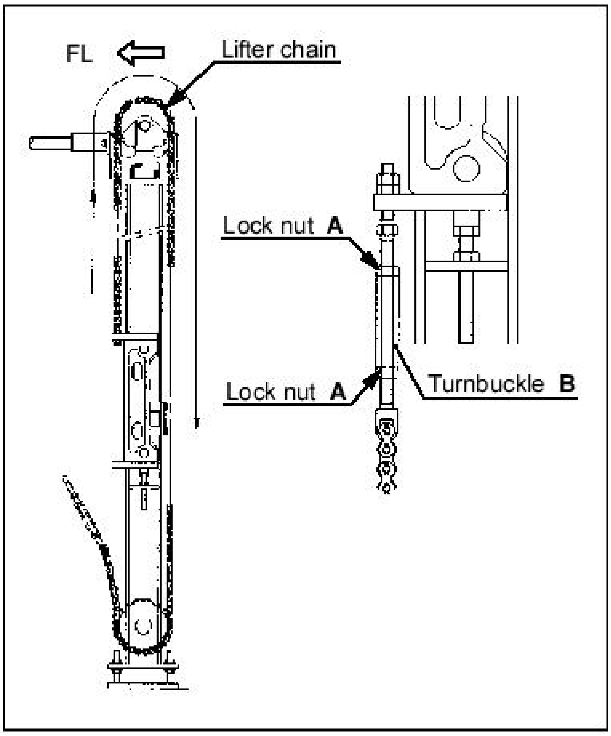
	1	F7801-27010-00
	2	81303-10060
	3	81304-08020

(3) Hold a mechanical stopper to the roller of the slide.

(4) Adjusting side roller

- Place a shim (0.35 mm) between the side roller and the inner wall of the pillar and fix the side roller.

2.3.9 Lifter Chain


FL
Lifter chain
Lock nut **A**
Lock nut **A**
Turnbuckle **B**

(1) Install the lifter chain to the slide.

(2) Adjust the lifter chain tension.

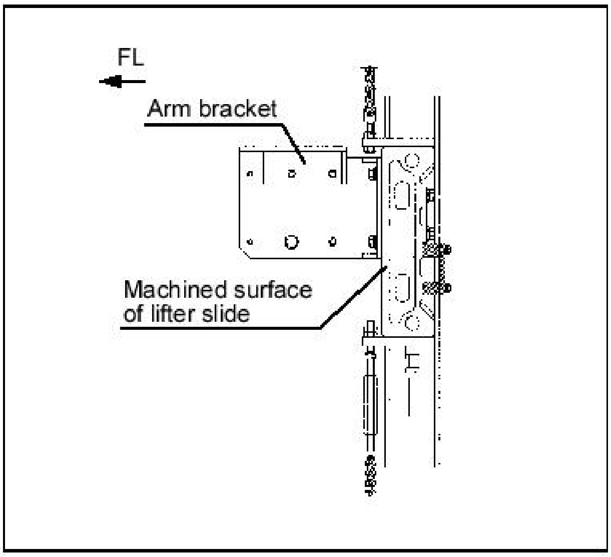
1) Loosen the upper and lower lock nuts **A**.

2) Adjust the tension using the turnbuckle **B**.

3) Tighten the upper and lower lock nuts **A**.

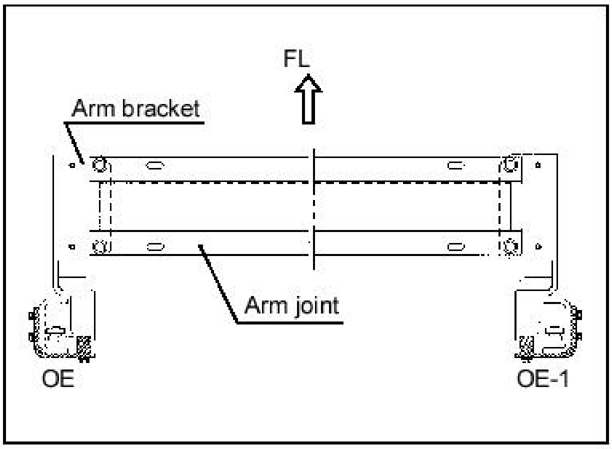
NOTE: Make the final adjustment of tension after completing the assembly of all the lifters.

2.3.10 Arm Bracket


FL
Arm bracket
Machined surface
of lifter slide

Joint the machined surface of the lifter slide and the end face of arm bracket and fix them.

2.3.11 Arm Joint


FL
Arm bracket
Arm joint
OE
OE-1

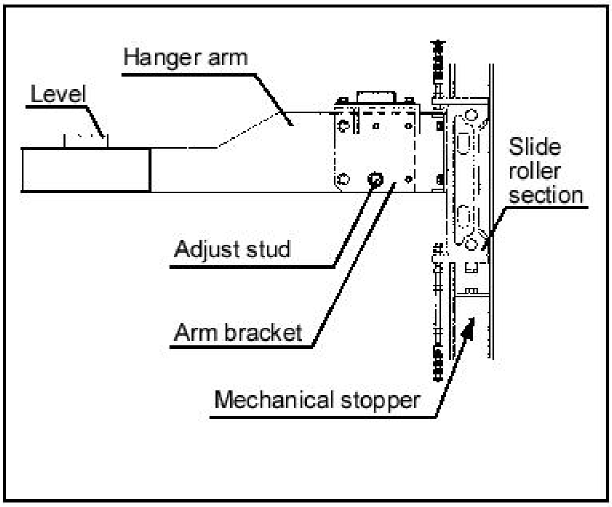
(1) Place and fix the arm joint on the arm bracket.

(2) Remove the slide fastening tool of the pillar on the OE side and install it to the arm bracket second from OE.

(3) Install the arm joint similar to (1).

NOTE: After completing the installation of the arm joint, install other arm joint between the following pillar (2.3.8 to 2.3.11).

2.3.12 Hanger Arm


Hanger arm
Level
Slide roller section
Adjust stud
Arm bracket
Mechanical stopper

NOTE: Hold the mechanical stopper to the roller section of the slide roller.

(1) Install the hanger arm to the arm bracket temporarily.

(2) Tentatively level the hanger arm using the adjust stud (see 2.3.16).

2.3.13 Motor and Reduction Gear

NOTE: Hold the mechanical stopper to the roller section of the slide (see 2.3.12).

(1) Install the motor base to the drive pillar.

(2) Install the motor and the reduction gear to the slide base and adjust backlash. Install the tension bracket temporarily to the reduction gear.

(3) Temporarily assemble the slide base mounted with the motor and reduction gear on the motor base with four bolts.

(4) Install the adjust bar to the motor base.

(5) Set the drive chain to the sprocket.

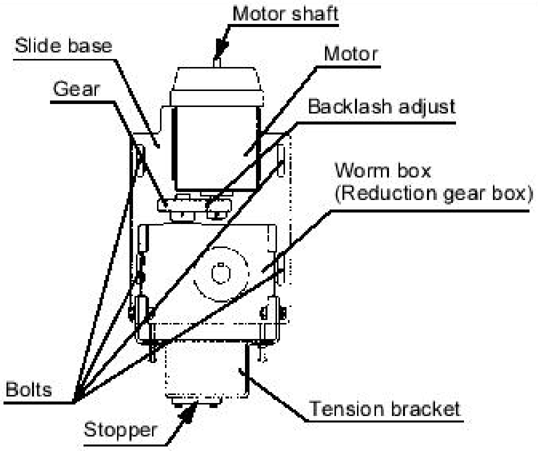
(6) Adjusting the drive chain tension

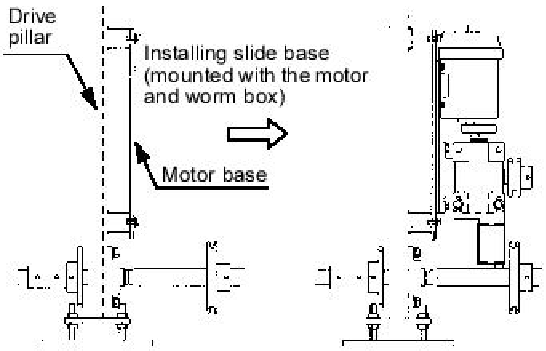
1) Loosen the four bolts slightly and raise the slide base with the adjust bolt.

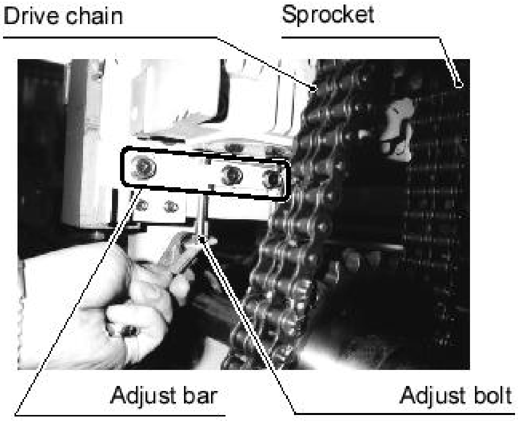
2) Rotate the motor shaft with the handle and equalize the chain tension on the tight and slack portions.

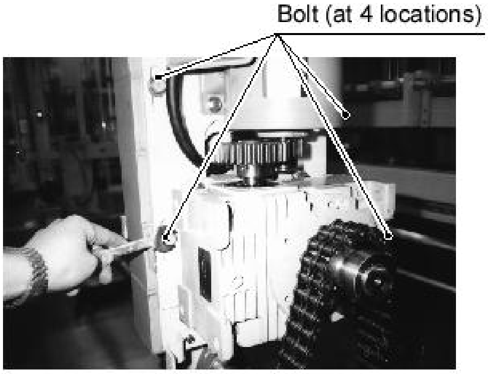
3) Repeat steps 1) and 2) while watching the tension on both portions.

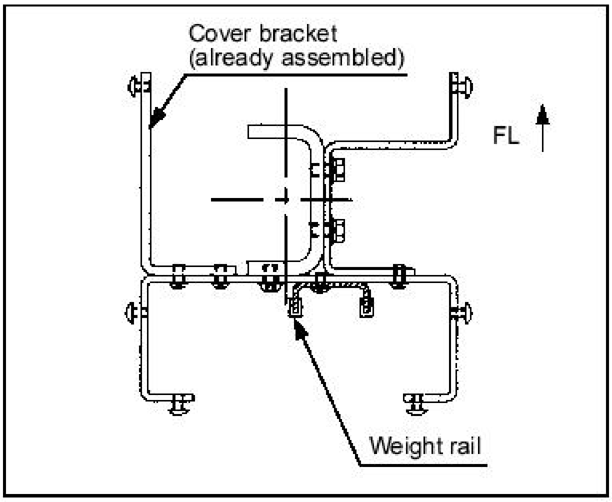
4) After adjusting the tension, fix the slide base with four bolts.


Motor shaft
Slide base
Motor
Gear
Backlash adjust
Worm box
(Reduction gear box)
Bolts
Tension bracket
Stopper


Drive pillar
Installing slide base (mounted with the motor and worm box)
Motor base


Drive chain
Sprocket
Adjust bar
Adjust bolt


Bolt (at 4 locations)

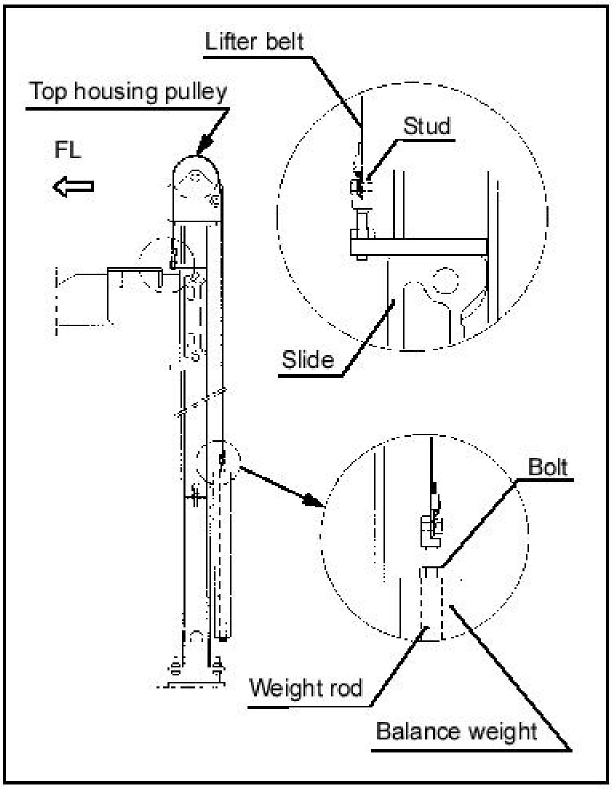

Cover bracket
(already assembled)
FL
Weight rail

2.3.14 Cover Bracket and Weight Rail

(1) Install the cover bracket to the pillar.

NOTE: When installing the cover, care should be taken for the type of cover bracket.

(2) Install the weight rail to the cover bracket.


Lifter belt
Top housing pulley
FL
Stud
Slide
Bolt
Weight rod
Balance weight

2.3.15 Balance Weight and Lifter Belt

NOTE: When installing or removing the balance weight to or from the lifter belt, always raise the lifter to near the top.

(1) Prior assembly of balance weight

1) Put the weight rod mounted with the bolt on the lower surface.

2) Install the stud to the top surface of the weight rod.

NOTE: Align the groove of the weight.

(2) Install the stud and lifter belt to the slide.

(3) Place the lifter belt to the pulley of the top housing and install the balance weight.

(4) Check if the lifter belt is twisted. If twisted, adjust it by turning the stud.

■ **How to change lifter belt**

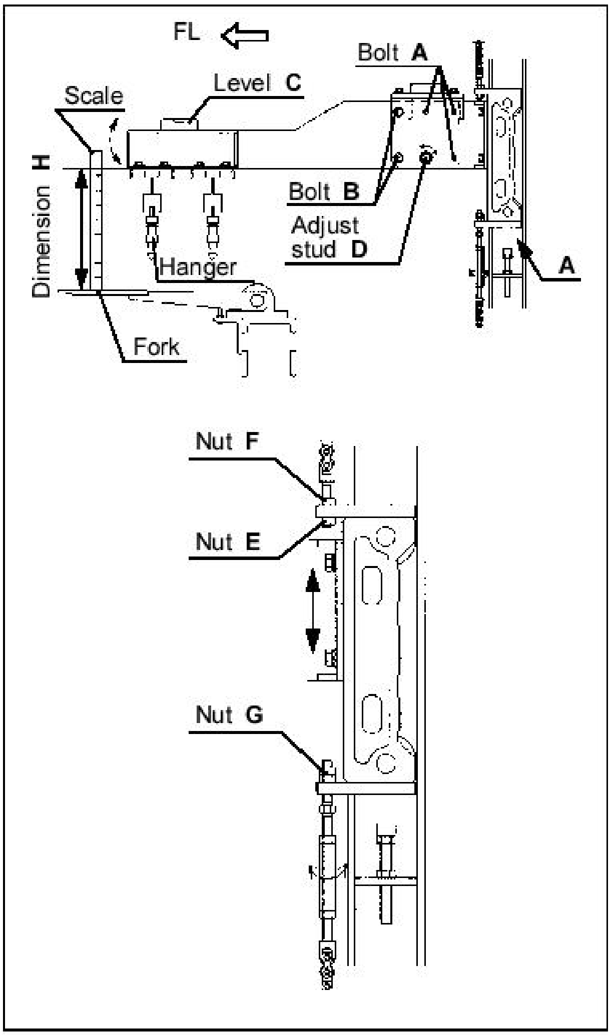
- When replacing a lifter belt, set the lifter to the datum.
- Hanger shall have no full bobbin.

(1) Remove the balance weight from the lifter belt.

(2) Remove the lifter belt from the stud of the slide.

(3) Install the balance weight and lifter belt according to the balance weight installation procedures.

2.3.16 Adjusting Hanger Arm Position



NOTES:

- When making adjustment, be sure that the hanger does not carry a bobbin.
- Move the lifter and carrier by handle to the positions indicated in the diagram to the left. (Lifter stop position when operation is enabled: L2) See 3.3.7.
- Always hold the fork on level position.
- Clearance must exist between the mechanical stopper and slide roller.

(1) Install the hanger rail to the hanger arm.

(2) Level adjustment of hanger arm

1) Loosen bolts **A** and **B** slightly.
2) Place the level **C** to the tip of the hanger arm.
3) Rotate the adjust stud **D** to level the hanger arm.
4) After level adjustment, tighten bolts **A** and **B**.

(3) Height adjustment of hanger arm

1) Measure the dimension between the fork top surface and the hanger arm using a scale and render the reading as the reference dimension.
2) Adjust the height of other hanger arms to the reference dimension.

   Dispersion in height: within ±2 mm

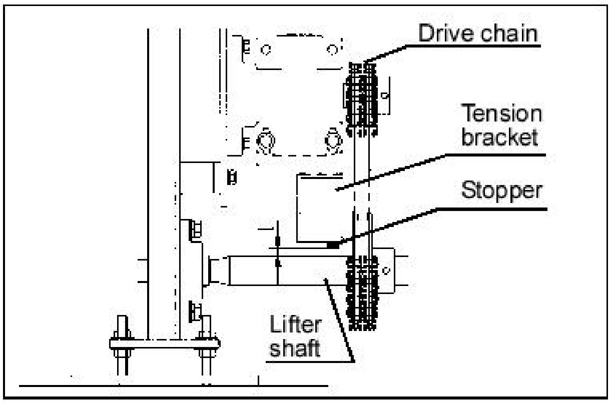
■ **When raising the hanger arm**

a. Loosen nuts **F** and **G** slightly.
b. Tighten lock nut **E** and raise the lifter arm.
c. Tighten nuts **F** and **G**.

■ **When lowering the hanger arm**

a. Loosen nut **E** slightly and lower the hanger arm.
b. Tighten nut **F**.

2.3.17 Tension Bracket

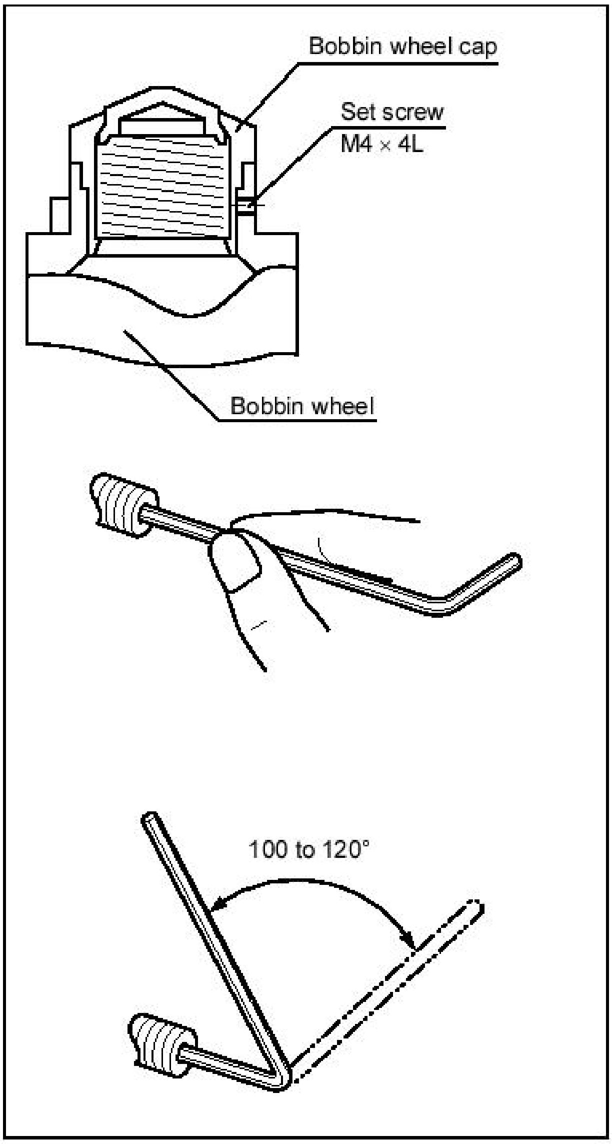


The tension bracket is a device to prevent the drive chain from skipping the tooth.

(1) Hang a full bobbin to the hanger.

(2) Set the dimension between the lifter shaft and the stopper to 1 mm and fix the tension bracket.

2.4 FL200 Bobbin Wheel Installation



Install the bobbin wheel as follows to prevent loosening of the bobbin wheel cap:

■ **Set screw tightening method**

(1) After screwing about 2 mm from the tip end into the bobbin wheel, apply screw locking agent 1401B attached to the frame on the outer side of the screw.

The locking agent may be applied beforehand wholly on the screw threaded portion.

(2) Hold the hexagon wrench (width across flats: 2 mm) at its straight portion with the thumb and forefinger, and tighten the screw until its tip end comes into contact.

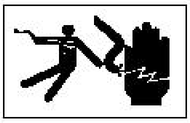
(3) Turn the wrench by 100 to 120° from the position where the screw tip end comes into contact.

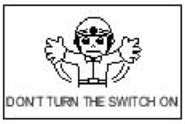
(4) After tightening the screw, wipe the oozed-out screw locking agent to prevent obstruction of bobbin fitting.

3. PREPARATIONS FOR TRIAL RUN

3.1 Adjustment before Trial Run

3.1.1 Checking Electrical Wiring



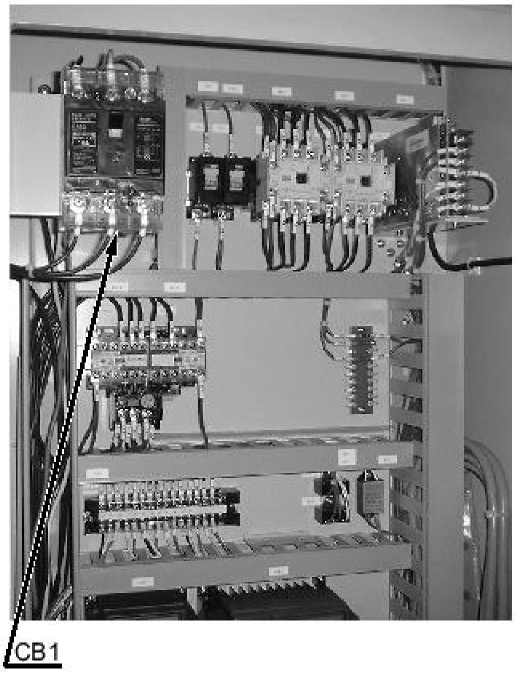

DON'T TURN THE SWITCH ON

⚠ WARNING

FL200 INSTRUCTION MANUAL, Section S.1 “Safe Work”

S.1.4 Carry out the checking by observing the “Rules for Handling and Inspecting Electrical Units.”

- lectrical equipment should be handled by an appropriately trained specialist or electric technician.
- Check that the main breaker (CB1) is turned OFF, and hand a warning board reading “DON’T TURN THE SWITCH ON” on the main breaker.



(1) Checking the motor wiring connection
 1) Carrier motor (M1)
 2) Lifter motor (M2)
 3) Fork motor (M3)

(2) Checking the sensor wiring connection
 1) Floating carrier sensor, PRS1 to 6, and PRS11 to 16
 2) Position detect sensor, PRS100 to 102, 200 to 204, 210 to 214, 300, 301, LS1 and 2
 3) Bobbin detect sensor, PHR/PHL1 to 4
 4) Obstacle detect sensor, PHR/PHL5 and 100
 5) Safety door switch, SW1 and 2

NOTE: Check that no condensive capacitor, etc. is used between the inverter output terminal (U.V.W) and the motor.

3.2 Energizing and Checking Voltage of Respective Sections

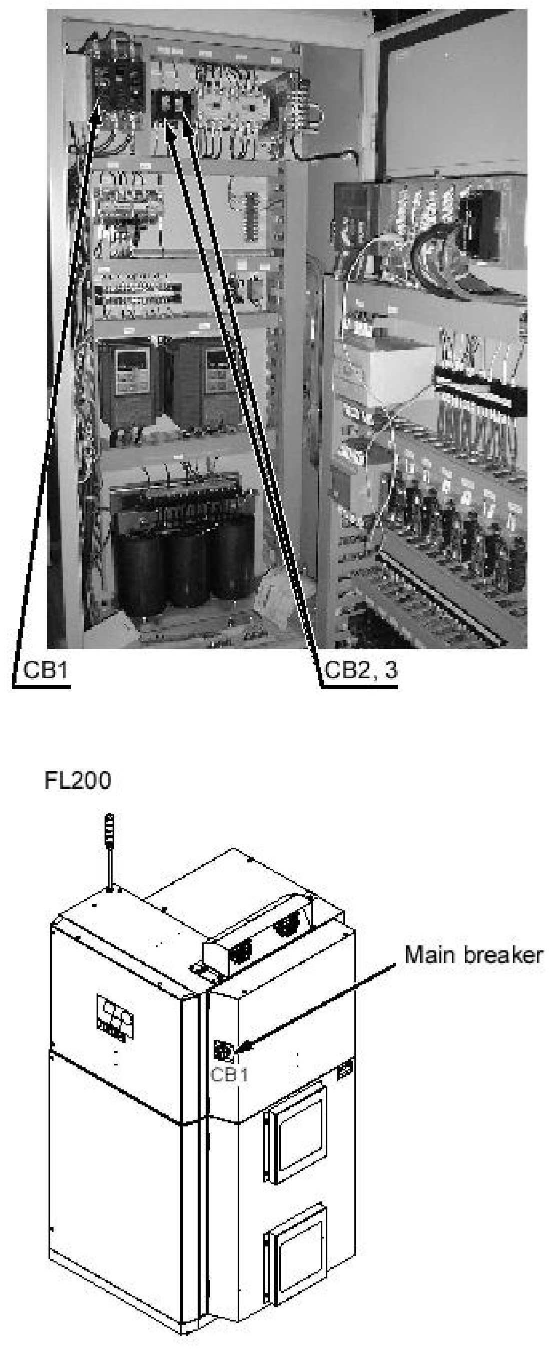
⚠ WARNING

FL200 INSTRUCTION MANUAL, Section S.1 “Safe Work”

S.1.4 Carry out the checking by observing the “Rules for Handling and Inspecting Electrical Units.”

- Electrical equipment should be handled by an appropriately trained specialist or electric technician.
- Since the power supply of the factory and control system are checked with the hot-line portions, full care should be taken not to touch the hot-line by part of the body.
- Use all the measuring instruments and tools in perfect working conditions.
- Since an inverter is used, the power is charged even if the main breaker is turned OFF. Wiring may be touched directly 10 minutes later or longer after the main breaker was turned OFF.

Check the following items after completing the adjustment of respective FRD sections:



3.2.1 Preparations

(1) Check that the main breaker CB1 located in the main control box is turned OFF.

(2) Check that CB2 and CB3 in the control box are also turned OFF.

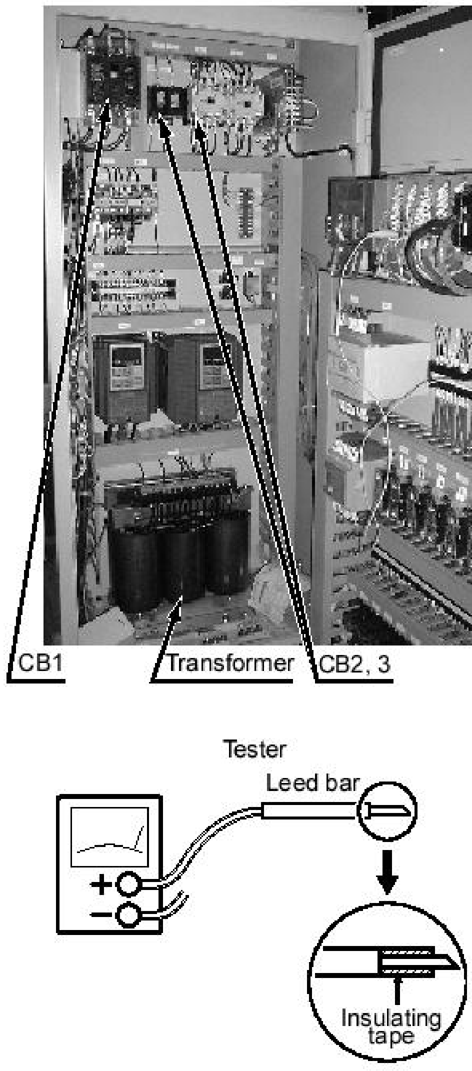
(3) Turn the main breaker of FL200 ON.

(4) Check that the primary voltage of the main breaker CB1 of the machine is within +/–5% of the specified voltage.

3.2.2 Checking Voltage

(1) Turn the main breaker CB1 ON.

(2) Use a tester to check that voltages on the secondary side of CB1 (R2, S2, and T2) are within +/–5% of the specified voltage.



(3) Check the voltage on the outside of the transformer.

  1) Voltage between R3, S3 and T3 is respectively 200 VAC+/–5% (when the supply voltage is specified for other than 200 VAC).

  2) Voltage between R10 and T10 is 100 VAC+/–5%.

(4) Turn CB1 OFF.

(5) Turn CB2 in the control box ON.

(6) Turn CB1 ON. Check the output voltage of 24 VDC at the terminal board of the switching regulator PS1. The output voltage will be 24VDC+/–5%.

(7) Turn CB1 OFF.

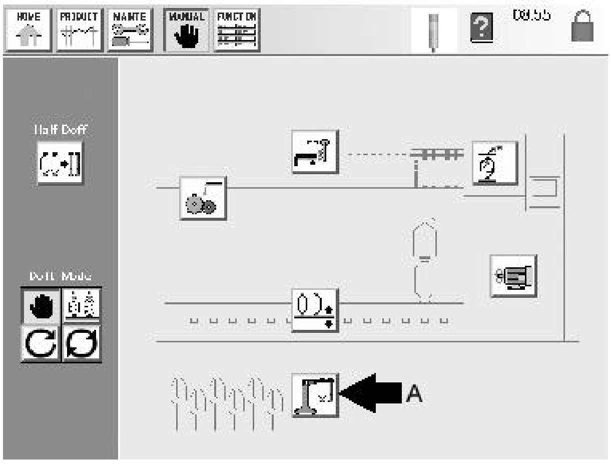
(8) Turn CB3 ON.

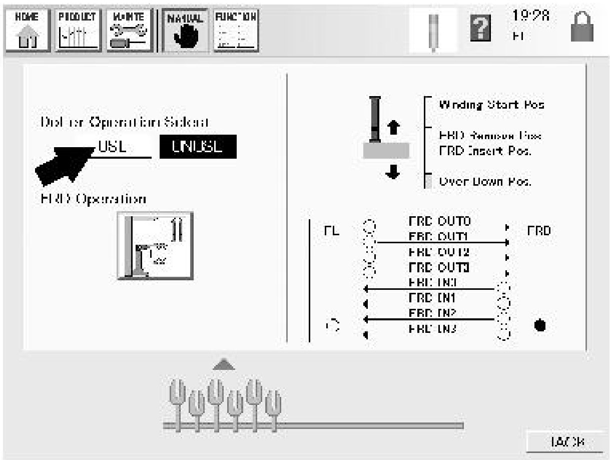
(9) Turn CB1 ON.

(10) Measure the voltage of CB3 on the secondary side (the reference voltage being N).

NOTE: To avoid contact between terminals, expose the conductive portion only at the tip of the bar of the lead tester. Wrap the rest of the bar with insulating tape.

3.3 Checking and Adjustment during Trial Run


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
08:55
Half Doff
Doff Mode
A


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
19:28
FL
Winding Start Pos
FRD Remove Pos
FRD Insert Pos.
Over Down Pos.
FL
FRD
FRD OUT0
FRD OUT1
FRD OUT2
FRD OUT3
FRD IN0
FRD IN1
FRD IN2
FRD IN3
BACK

Doffer Operation Select
USE UNUSE

FRD Operation

■ FL200

- Select the doffer use mode **A** with the operating panel.
- Make adjustment after lowering the bobbin rail to the over-down position.
- FRD interlock is changed to [USE].

■ FRD

- Turn the power ON after energization and checking voltage of respective sections (see 3.2).
- Install the sensors to approximate positions and adjust them after 3.3.1.
- If the following errors should occur after turning the power ON, take respective corrective actions.

(1) No. 2-1 Emergency stop tripped by the safety door switch
→Temporarily adjust the safety door switches (SW1 and 1) (see 3.3.2).

(2) No. 2-2 Emergency stop tripped by the area sensor
→Cancel the area sensor with the key switch (see 6.6).

(3) No. 3-4 Carrier overrun
→Temporarily adjust the dog for overrun (see 3.3.10).

(4) No. 3-5 Lifter overrun
→Temporarily adjust the pillar limit switch (see 3.3.8).

- If emergency stop occurs by error No. 2-4 entry detection:

1) Shortcircuit 139 and N to turn the projector of the entry detect sensor ON.

2) Adjust the projector and photo detector. Match the optical axis to turn the photo detector ON.

3) Cancel the shortcircuit between 139 and N.

NOTES:

- Carry out steps 1) and 3) with the power OFF.
- Don't disable the entry detect sensor as it is hazardous.

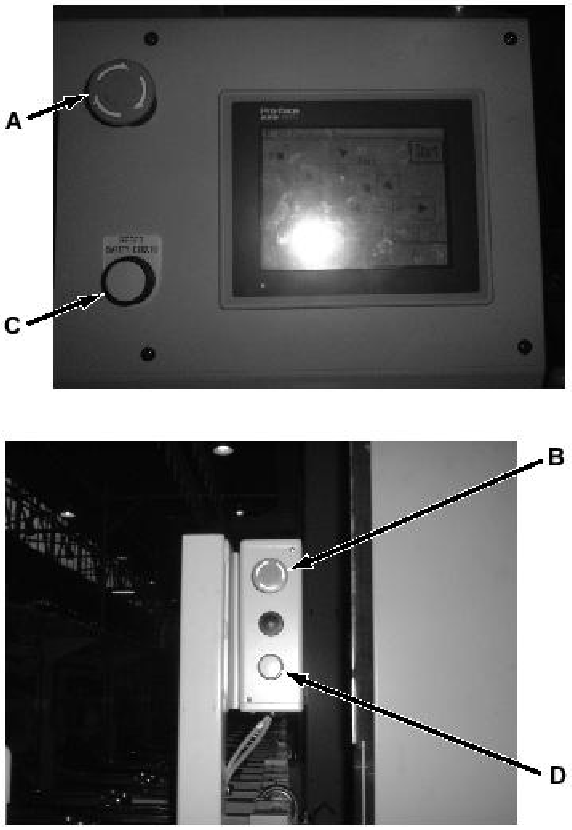
3.3.1 Checking Operation of the Safety Circuit

⚠ CAUTION

FL200 INSTRUCTION MANUAL, Section S.1 “Safe Work”

S,1.2 Carry on the checking by observing the “Rules for Safe Operation.”

- Before operating a machine, two persons should jointly check the operation of the safety circuit.
- When operating the machine, don’t start it without signaling the co-worker or without checking the reply from the co-worker to a given signal.
- Don’t touch the revolving portions or operating sections of the machine by hand before the machine comes to full stop.

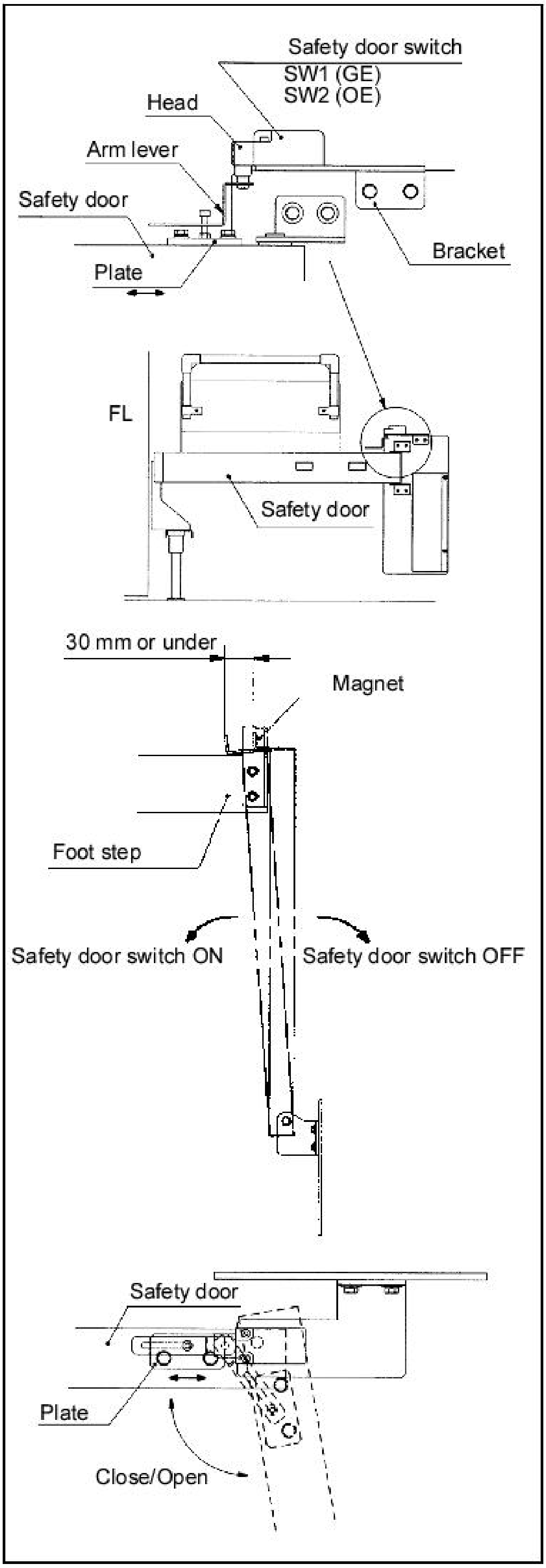


(1) Check that “Error E-2-3 Emergency Stop by Emergency Stop Button” is displayed on the operation panel and the power circuit cut off when emergency buttons PB1 **A** and PB2 **B** are depressed. (Use a tester to check that the voltage of R5, S5 and T5 is 0 (zero) volt.

(2) Reset the emergency button, and depress the alarm reset on the panel to erase the message.

(3) When the safety doors to GE and OE are opened, check that the safety circuit works and the operating panel indicates a message to the effect that “Emergency stop tripped by Error W-2-1 safety door switch.” (see 5.3.14)

(4) Close the safety door and depress the safety circuit reset buttons PB2 **C** and PB4 **D** and check that the error message is deleted.


Safety door switch
SW1 (GE)
SW2 (OE)
Head
Arm lever
Safety door
Plate
Bracket
FL
Safety door
30 mm or under
Magnet
Foot step
Safety door switch ON
Safety door switch OFF
Safety door
Plate
Close/Open

3.3.2 Adjusting the Safety Door Switch

The safety door switch is a device for detecting that a worker has entered the FRD working area from the GE and OE safety doors.

- If the safety door is opened during automatic or manual operation, FRD enters emergency stop state.

(1) Installation and adjustment

1) Install the safety door switches (SW1 and SW2) to the safety door.

NOTE: To install, reverse the switch head so that the arm lever will be on the lower side.

2) Turn the power ON.

3) Adjust the plate or switch so that the switch will be turned ON (signal input OFF) when the safety door opens 30 mm or less.

- When the switch is turned ON, "W-2-1 Emergency Stop by Safety Door" is displayed as a message.
- To reset, close the safety door and press the reset button (yellow).

3.3.3 Checking the Direction of the Motor Revolution

⚠ WARNING

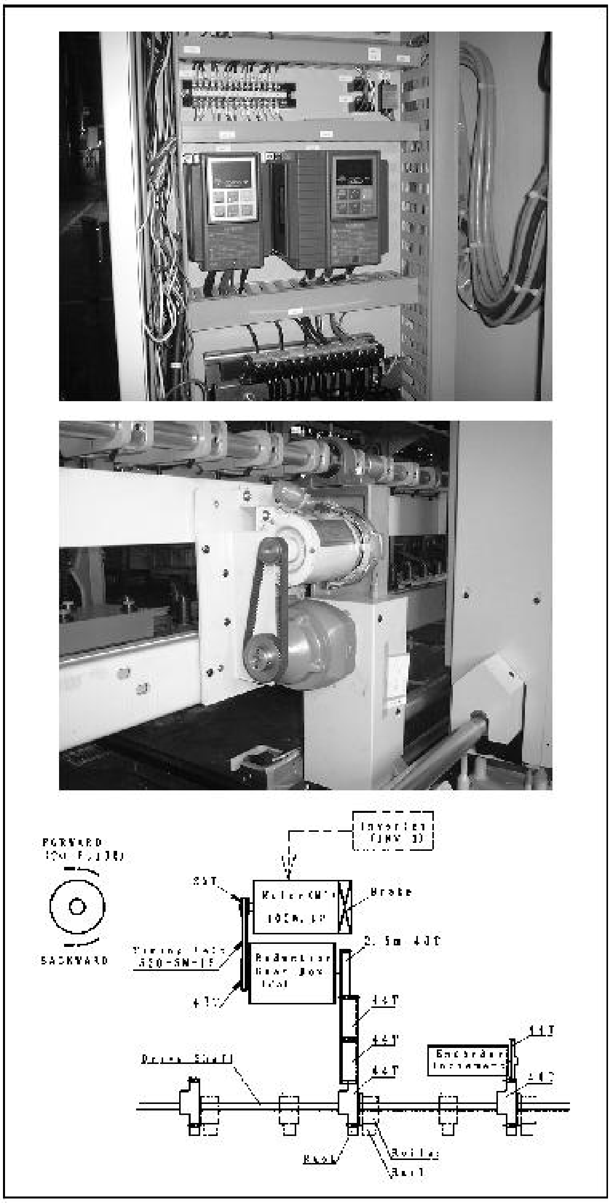
FL200 INSTRUCTION MANUAL, Section S.1 “Safe Work”

Carry on the checking by observing the following rules:

S.1.2 “Rules for Safe Operation”

S.1.3 “Rules for Maintenance Work”

S.1.4 “Rules for Handling and Inspecting Electrical Units”


FORWARD
BACKWARD
Inverter
(INV 1)
Motor (M1)
Brake
Timing belt
Reduction Gear Box
44T
44T
44T
44T
Drive Shaft
Rack
Roller
Rail

(1) Checking the set value of the inverter Check the set value of the inverter according to item 5.2.2.

(2) Checking the direction of revolution of the carrier motor

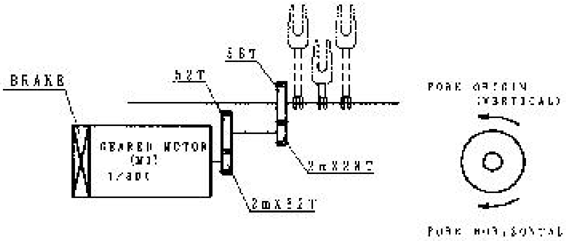
1) Remove the timing belt to make the motor operable independently.

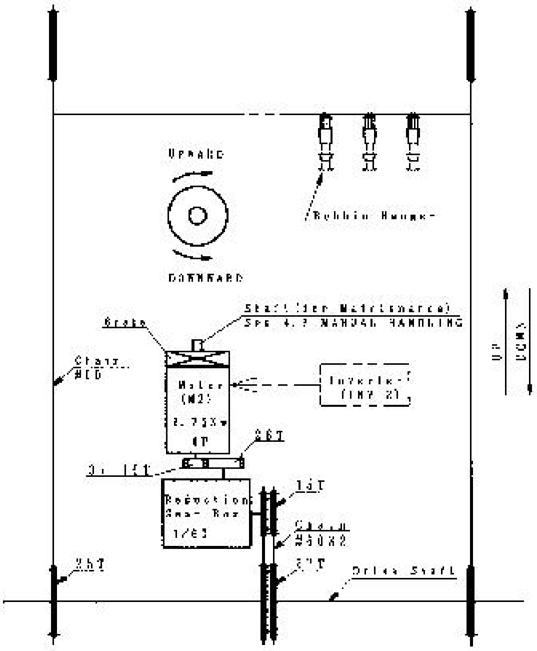
2) Make forward and backward motion on the position change screen (see item 4.1.10) and check the direction of motor revolution.

Direction of revolution as observed from the pulley side:

Operation	Direction of revolution
Forward	↺
Backward	↻

3) If the direction of revolution is incorrect, check the wiring.


BRAKE
52T
56T
GEARED MOTOR
(M1)
2mX28T
2mX52T
FORK ORIGIN
(VERTICAL)
FORK HORIZONTAL


UPWARD
DOWNWARD
Bobbin Hanger
Shaft (for Maintenance)
See 4.? MANUAL HANDLING
Brake
Chain
Motor
(M2)
0.75Kw
4P
Inverter
(INV 2)
UP
DOWN
26T
Reduction
Gear Box
13T
Chain
#50X2
25T
Drive Shaft

(3) Checking the direction of fork motor revolution

1) Disengage the gear that links the fork and the motor to enable the motor to revolve independently from the fork.

2) Revolve the fork motor under the position transfer in the maintenance mode (4.1.10) to check the direction of revolution.

Direction of revolution as observed from GE side:

Operation	Direction of revolution
F0 to F1	↻
F1 to F0	↺

3) If the direction of revolution is incorrect, check the wiring.

(4) Checking the direction of revolution of the lifter motor

1) Move the lifter by handle operation to near the center section of the pillars.

2) Raise and Lower the lifter on the position change screen (see item 4.1.10) and check the direction of transfer of the lifter.

When the motor is viewed from above:

Operation	Direction of revolution
Ascend	↻
Descend	↺

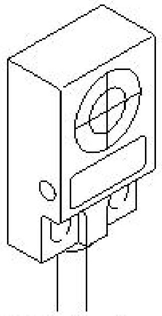
3) If the direction of revolution is incorrect, check the wiring.

3.3.4 Checking Respective Detect Sensors

NOTE: Check the operation of sensors in the emergency stop condition.
If any abnormality is detected, check the wiring.

Check operation by the indicator lamp of the sensor and sequencer.

(1) Proximity switch PRS1 to 6, and 11 to 16
(For detecting floating carrier)

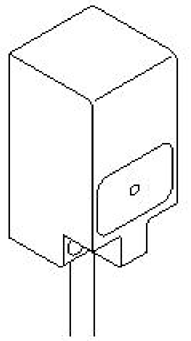


For the installation position of respective sensors, refer to A. APPENDIX A.1.

■ **Checking operation**

1) Remove sensors PRS1 to 6 and 11 to 16 from the carrier frame.
2) Turn the power ON.
3) Check that the sensor indicator lamp is OFF and the sequencer input port is OFF.
4) When a piece of iron is brought to 2 to 3 mm from the detecting surface of respective sensors, check that the sensor indicator lamp lights up green (stable area) and that the corresponding sequencer input port it turned ON.

	Corresponding PRS	Sequencer input	
		Unit	Port
Detect floating, front raw	PRS 1 to 6	1	5
Detect floating, rear raw	PRS 11 to 16	1	6



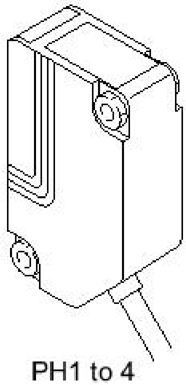
For the installation position of respective sensors, refer to A. APPENDIX A.1.

Sensor	Object of detection	Sequencer input	
		Unit	Port
PRS100	Carrier at origin	0	0
PRS101	Carrier forward overrun	0	1
PRS102	Carrier backward overrun	0	2
PRS200	Lifter L0 stop position	0	3
PRS201	Lifter L1 stop position	0	4
PRS202	Lifter L2 stop position	0	5
PRS203	Lifter L3 stop position	0	6
PRS204	Lifter L4 stop position	0	7
PRS210	L0 deceleration position	0	8
PRS211	L1 deceleration position	0	9
PRS212	L2 deceleration position	0	A
PRS213	L3 deceleration position	0	B
PRS214	L4 deceleration position	0	C
PRS300	Fork F0 stop position	1	0
PRS301	Fork F1 stop position	1	1

(2) Proximity switch PRS 100 to 214 and 300 to 301
(For detecting the carrier, lifter and fork position)

■ **Checking operation**

1) Turn the power ON.
2) Check that the sensor indicator lamp is OFF and the sequencer input port is OFF.
3) When a piece of iron is brought to 2.5 to 4 mm from the detecting surface of respective sensors, check that the sensor indicator lamp lights up green (stable area) and that the corresponding sequencer input port it turned ON.


PH1 to 4

(3) Photoelectric switch PH1 to 4, and 6 to 8 (For detecting bobbin, obstacle and collapsed bobbin shoulder)

NOTE: Optical axis shall have no shielding object on the path.

■ Checking operation

1) Turn the power ON.
2) Turn only the sequencer output port ON of the projector to be checked. (see 4.1.19)
3) Check that the indicator lamp of photo detector is lit.
4) Check the following three points:
- Operation indicator lamp (red) of the photo detector is lit.
- Stable indicator lamp (green) of the photo detector is lit.
- The sequencer input port of the photo detector is turned ON.
  If the operation and stable indicator lamps are not on, align the optical axis.

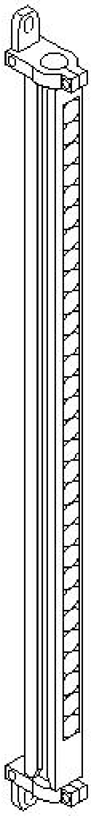
5) Place a shielding substance on the optical axis and check the three following points:
- The operation indicator lamp of the photo detector goes off.
- The stable indicator lamp of the photo detector goes off.
- The sequencer input port of the photo detector is turned OFF.

6) Turn the sequencer output port of the checked photo detector OFF.

NOTE: See the table below for the photo detector sensitivity adjust knob.

Detection	Projector			Photo detector			Sensitivity adjust knob
	Sensor	Sequencer output		Sensor	Sequencer input		
		UNIT	Port		UNIT	Port	
Empty bobbin detect 1	PHL1	3	4	PHR1	1	8	MID
Empty bobbin detect 2	PHL2	3	5	PHR2	1	9	MID
Full bobbin detect 1	PHL3	3	6	PHR3	1	A	MID
Full bobbin detect 2	PHL4	3	7	PHR4	1	B	MID
Entry detect	PHL6	3	9	PHR6	1	D	MID
Collapsed shoulder detect 1	PHL7	3	A	PHR7	1	E	MID
Collapsed shoulder detect 2	PHL8	3	B	PHR8	1	F	MID

MID: Middle of adjustment range
MAX: Maximum limit of adjustment range



PH100

For the installation position of respective sensors, refer to A. APPENDIX A.1.

(4) Area sensor PH100

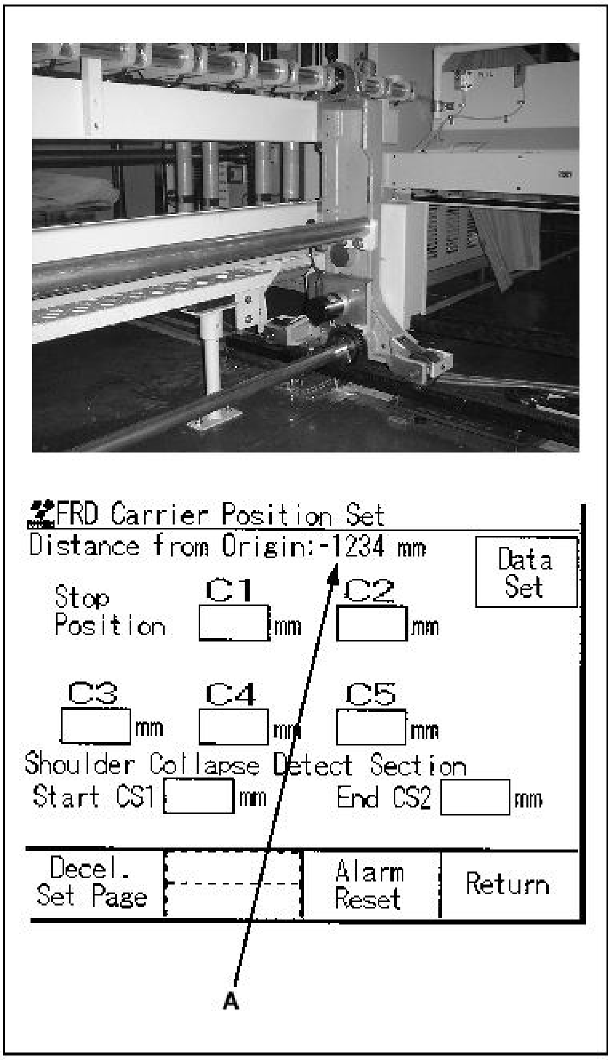
NOTE: Optical axis shall have no shielding object on the path.

■ **Checking operation**

1) To turn the projector of the area sensor ON, shortcircuit terminals 242 and P1.

NOTE: Take this step after turning the power OFF.

2) Turn the power ON.
3) Wait until the 7-segment display of the controller changes to C.
4) Check that the indicator lamp (yellow) of the projector is lit.
5) Check that the indicator lamp (green) of the photo detector is lit.
If not, match the photo axes.
6) Place a shielding object on the path of the photo axis and check that the indicator lamp (red) of the photo detector is lit.
7) Turn the power OFF.
8) Disconnect shortcircuited terminals 242 and P1.



FRD Carrier Position Set

Distance from Origin:-1234 mm

Data Set
Stop Position
C1
mm
C2
mm
C3
mm
C4
mm
C5
mm
Shoulder Collapse Detect Section
Start CS1
mm
End CS2
mm
Decel. Set Page
Alarm Reset
Return
A

3.3.5 Checking the Encoder

(1) Open the carrier position setting screen and check the carrier counter value **A**.

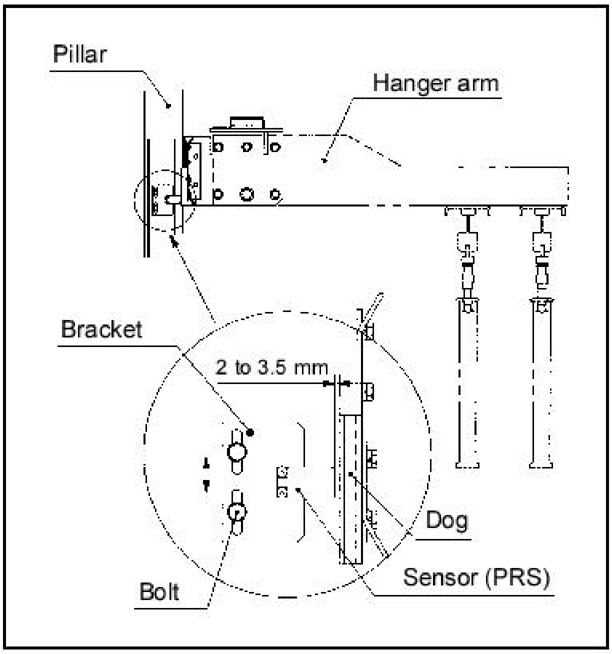
(2) Move the carrier forward or backward on the position change screen.

(3) Open the carrier position setting screen again, and check the carrier counter value **A**.
The operation is normal if the carrier counter value **A** increases after forward movement and decreases after backward movement.

REFERENCES:

- If the counter value does not change during both forward and reverse movement, check the wiring.
- If the counter value decreases during forward movement and increases in reverse, check if the wiring of phase A (17A) and phase B (17B) are replaced.
- If the counter value changes only during forward or reverse movement, check the dip switches of the counter unit. (see 5.2.1)

3.3.6 Adjusting the Starting Position of Lifter Arm Speed Reduction



Speed reduction starting position is determined by the position of the sensor mounted to the 3rd pillar from GE for 520 stuff or 4th pillar for 440 stuff.

NOTES:

- Set the dimension between the sensor and the dog to 2 to 3.5 mm.
- Make adjustment after adjusting the height of the fork. Fork should be in level position.
- Before making adjustment, check the operation of the sensor. (see 3.3.4)
- Measure the height by using a bobbin hung to the hanger.
- When adjusting the sensor installation position, set the machine to emergency stop state.
- Make adjustment at the position the sensor is installed without changing the position of the dog.

REFERENCE: Recommended order for adjusting the lifter arm deceleration start position

(1) Adjust speed reduction position L_d4

(2) Adjust speed reduction position L_d2

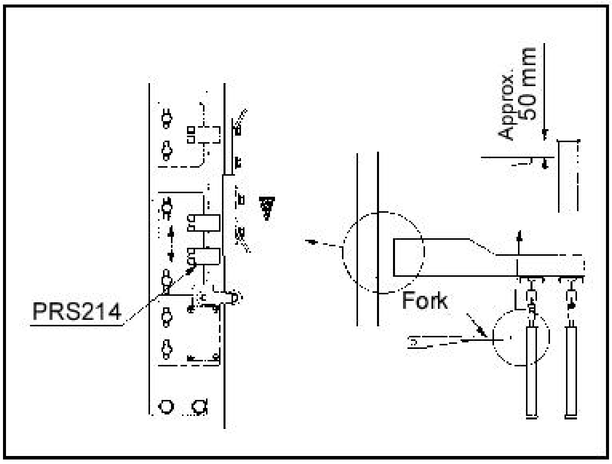
(3) Adjust speed reduction position L_d1

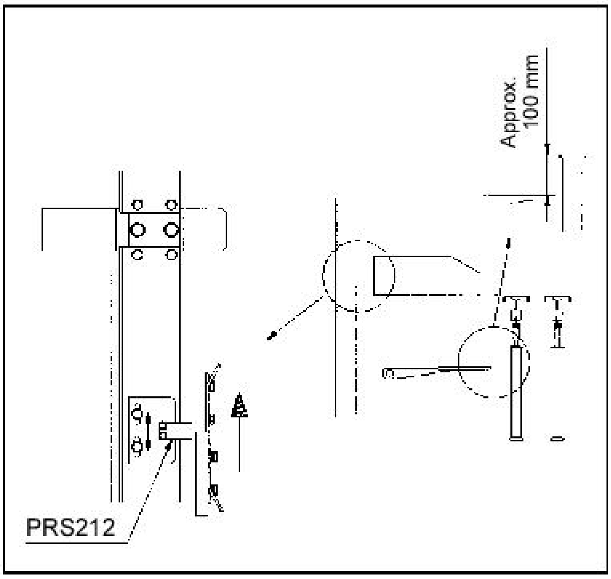
(4) Adjust speed reduction position L_d0

(1) Adjusting the deceleration start position L_d4

1) Move the lifter so that the distance between the top surfaces of the bobbin and the fork will be about 50 mm.

2) Adjust the sensor until the PRS214 indicator lamp turns green (stable area).

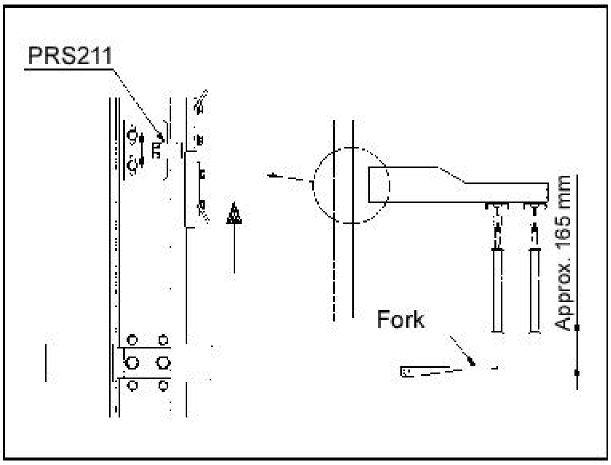




(2) Adjusting the speed reduction start point L_d2

1) Move the lifter so that the distance between the top surfaces of the bobbin and the fork will be about 100 mm.

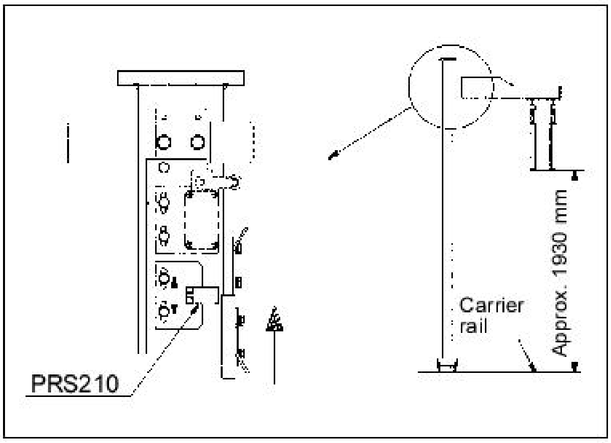
2) Adjust the sensor until the PRS212 indicator lamp turns green.



(3) Adjusting the speed reduction start point L_d1

1) Move the lifter so that the distance between the lower surface of the bobbin and the top surface of the fork will be about 165 mm.

2) Adjust the sensor until the PRS211 indicator lamp turns green.



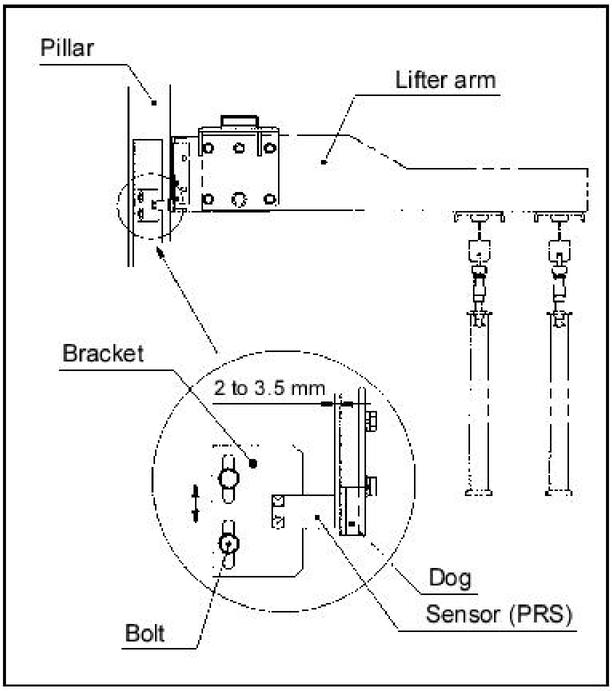
(4) Adjusting the speed reduction start point L_d0

1) Move the lifter so that the distance between the lower surface of the bobbin and the top surface of the carrier rail will be about 1930 mm*.

2) Adjust the sensor until the PRS210 indicator lamp turns green.

* In the case when the dimension from the lower surface of an empty bobbin at origin L0 to the carrier rail is 2000 mm.

3.3.7 Adjusting the Stop Position of Lifter Arm



The stop position is determined by the position of the sensor mounted t the pillar No. 2.

NOTES:

- Set the dimension between the sensor and the dog to 2 to 3.5 mm.
- Make adjustment after adjusting the height of the fork. Fork should be in level position.
- Before making adjustment, check the operation of the sensor. (see 3.3.4)
- Measure the height by using a bobbin hung to the hanger.
- When adjusting the sensor installation position, set the machine to emergency stop state.
- Make adjustment at the position the sensor is installed without changing the position of the dog.

REFERENCE: Recommended order for adjusting the lifter arm stop position

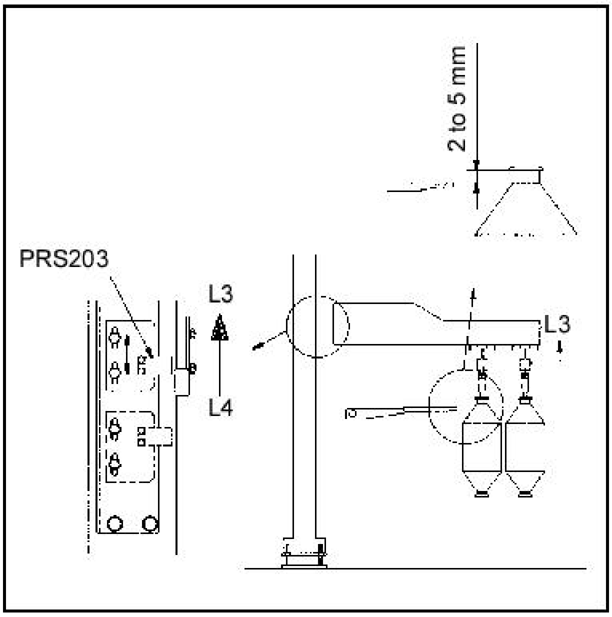
(1) Adjust stop position L3

(2) Adjust stop position L4

(3) Adjust stop position L2

(4) Adjust stop position L1

(5) Adjust origin L0



(1) Adjusting the stop position L3

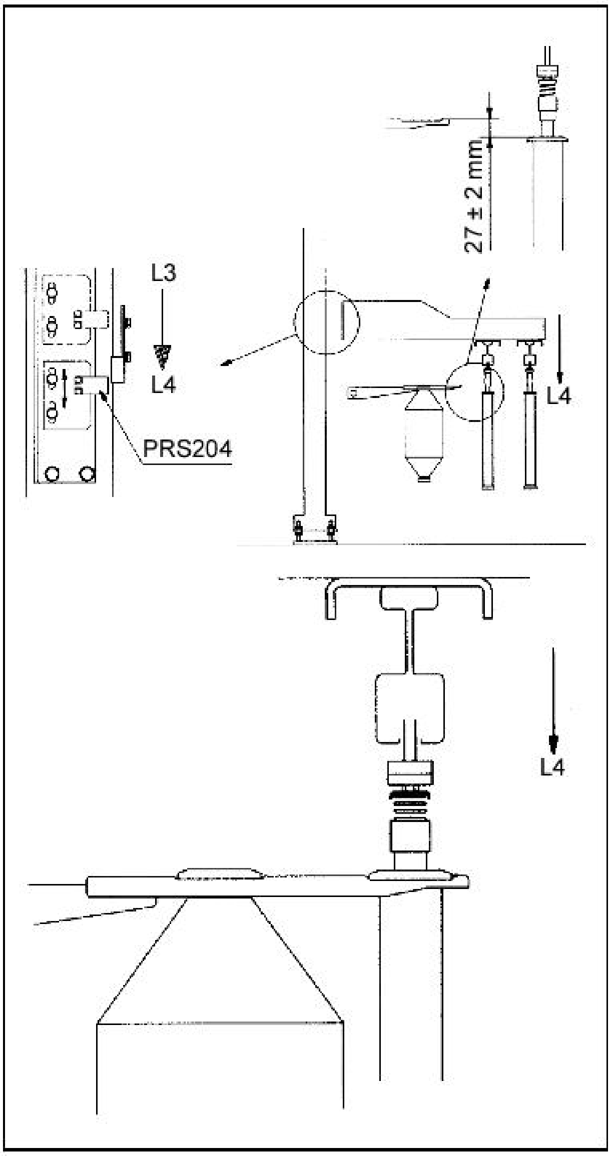
1) Move the lifter to a position where the top surface of the fork and the lower surface of the bobbin collar are not in contact to each other by using the panel and handle operation jointly. The clearance should be within 2 to 5 mm, however.

2) Adjust the sensor until the PRS203 indicator lamp turns green.

3) Lower the lifter to near L4 by handle operation.

4) Raise the lifter to L3 by panel operation for position transfer.

5) Check the clearance from the top surface of the fork to the lower surface of the bobbin collar. If another adjustment is required, follow steps 2), 3) and 4).



(2) Adjusting the stop position L4

1) Move the lifter by handle operation to a position where the dimension between the top surfaces of the fork and the bobbin will be 27+/–2 mm.

2) Adjust the sensor until the PRS204 indicator lamp turns green.

3) Raise the lifter by panel operation to near L3, then lower to L4 again.

4) Check the dimension between the top surfaces of the fork and the bobbin. Follow steps 2) and 3) if another adjustment is required.

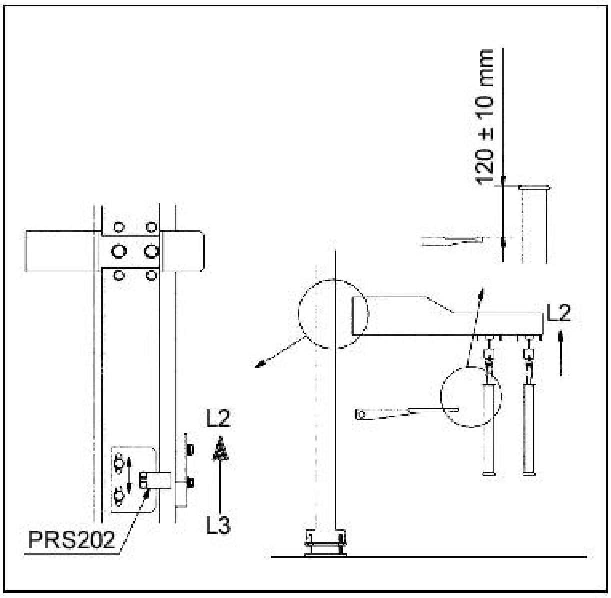
5) Hang an empty bobbin to the hanger and deliver the empty bobbin (*). Check that the hanger is switched without fully compressing the spring.

(*) How to deliver an empty bobbin

a. Move the lifter to L3. Advance the carrier forward so that the empty bobbin loading position of the fork will be to the center of the bobbin hung from the hanger. (In the case the carrier stop position has been already set, move to C2 by the position transfer.)

b. Lower the lifter from L3 to L4. Deliver the empty bobbin to the fork by switching the hanger.

c. Raise the lifter from L4 to L3. Then the bobbin is loaded on to the fork. If the bobbin fails to be switched, it remains hung from the hanger. Make another adjustment of L4 position.



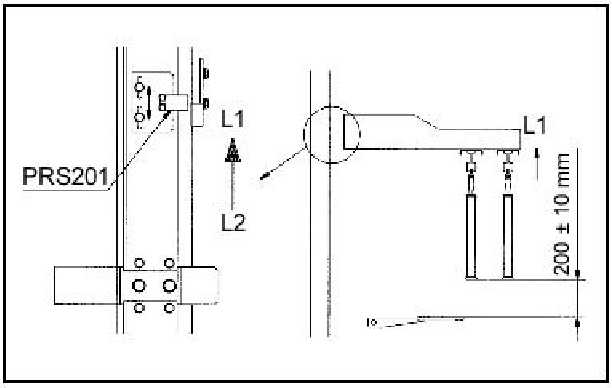
(3) Adjusting the stop position L2

1) Move the lifter by panel and handle operation jointly to a position where the dimension between the top surfaces of the fork and the bobbin will be 120+/–10 mm.

2) Adjust the sensor until the PRS202 indicator lamp turns green.

3) Lower the lifter by panel operation to near L3 and then raise to L2 again.

4) Check the dimension between the top surfaces of the fork and the bobbin. If another adjustment is required, follow steps 2) and 3).



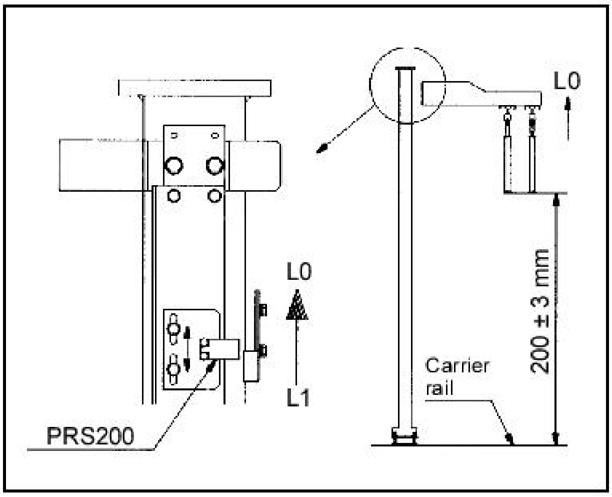
(4) Adjusting the stop position L1

1) Move the lifter by panel and handle operation jointly to a position where the dimension from the top surface of the fork to the lower surface of the bobbin will be 200+/–10 mm.

2) Adjust the sensor until the PRS201 indicator lamp turns green.

3) Lower the lifter by panel operation to near L2 and then raise to L1 again.

4) Check the dimension from the top surface of the fork to the lower surface of the bobbin. If another adjustment is required, follow the steps 2) and 3).



(5) Adjusting the origin L0

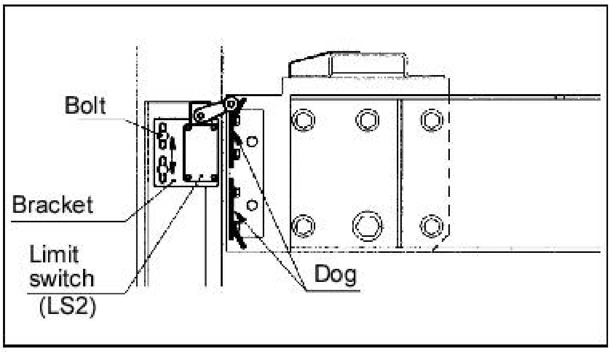
1) Raise the lifter by both panel and handle operation to a position where the dimension from the carrier rail to the lower surface of the bobbin will be 2000+/–3 mm.

2) Adjust the sensor until the PRS200 indicator lamp turns green.

3) Lower the lifter to near L1 by panel operation and then raise it to L0.

4) Check the dimension from the carrier rail to the lower surface of the bobbin. If another adjustment is required, follow the steps 2) and 3).

3.3.8 Adjusting the Overrun of Lifter Arm



(1) Adjusting the top overrun (LS2)

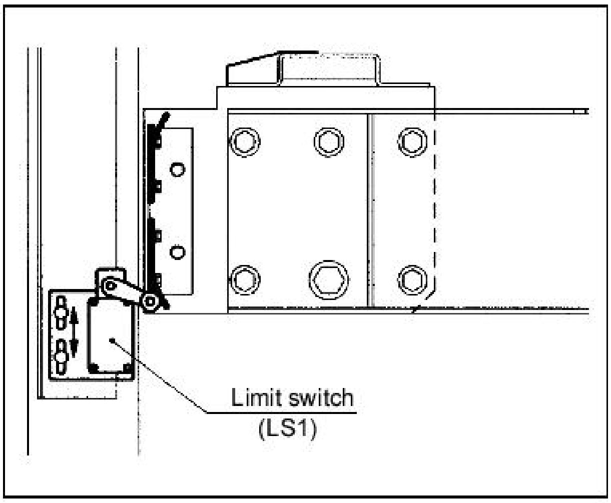
- The limit switch LS2 for the top will operate at a position where the lifter is raised 2 to 3 mm from the origin (L0).

  NOTE: Make adjustment again in the case the origin is changed.

ADJUSTMENT:

1) Raise the lifter to the origin L0.
2) Turn the power OFF.
3) Raise the lifter 2 to 3 mm by handle operation.
4) Turn the power ON (to the emergency stop state).
5) Adjust the position of the bracket until the limit switch turns ON.

   REFERENCE: Check that the limit switch is turned ON with the LED (port E of the unit 0) of the sequencer.



(2) Adjusting the bottom overrun (LS1)

- The limit switch LS1 for the bottom will operate at a position where the lifter is lowered 2 to 3 mm from L4.

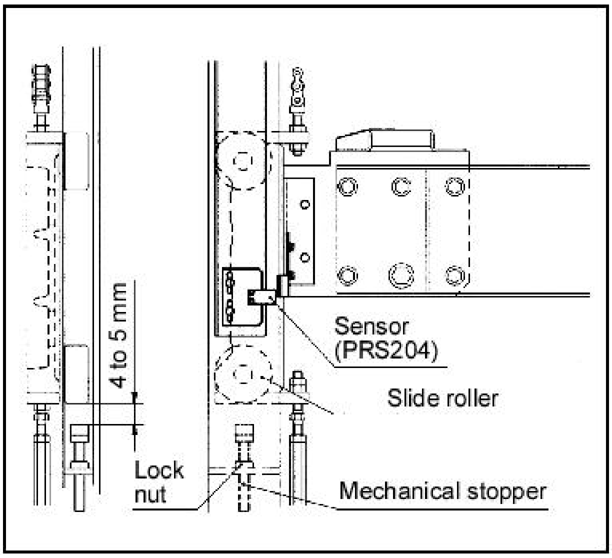
  NOTE: Make another adjustment if the stop position L4 is changed.

ADJUSTMENT:

1) Lower the lifter to L4.
2) Turn the power OFF.
3) Lower the lifter 2 to 3 mm by handle operation.
4) Turn the power ON (to the emergency stop state).
5) Adjust the position of the bracket until the limit switch turns ON.

   REFERENCE: Check that the limit switch is turned ON with LED (port D of the unit 0) of the sequencer.

3.3.9 Adjusting Mechanical Stopper of Lifter Arm


4 to 5 mm
Sensor (PRS204)
Slide roller
Lock nut
Mechanical stopper

(1) Lower the lifter to L4.

(2) Adjust the position of the stopper until the clearance between the slide roller and the mechanical stopper will be 4 to 5 mm.

NOTES:

- Adjust the mechanical stoppers of all the pillars.
- Make another adjustment if the stop position L4 is changed.

3.3.10 Adjusting the Carrier Position

NOTES:

- Adjust the carrier position after adjusting the lifter position.
- When making adjustment, keep the fork in level position.
- Check that no obstacle is present within the working space of FRD.
- Adjust the forward overrun position after adjusting the stop position C5.
- Adjust the reverse overrun position after adjusting the origin.
- If the origin is changed, all the stop positions must be adjusted again.

[1] Recommended Order for Adjusting the Carrier Position

(1) Adjust the origin C0.

(2) Adjust the reverse overrun position.

(3) Adjust the stop position C5.

(4) Adjust the forward overrun position.

(5) Adjust the stop position C3.

(6) Adjust the stop position C1.

(7) Adjust the stop position C2.

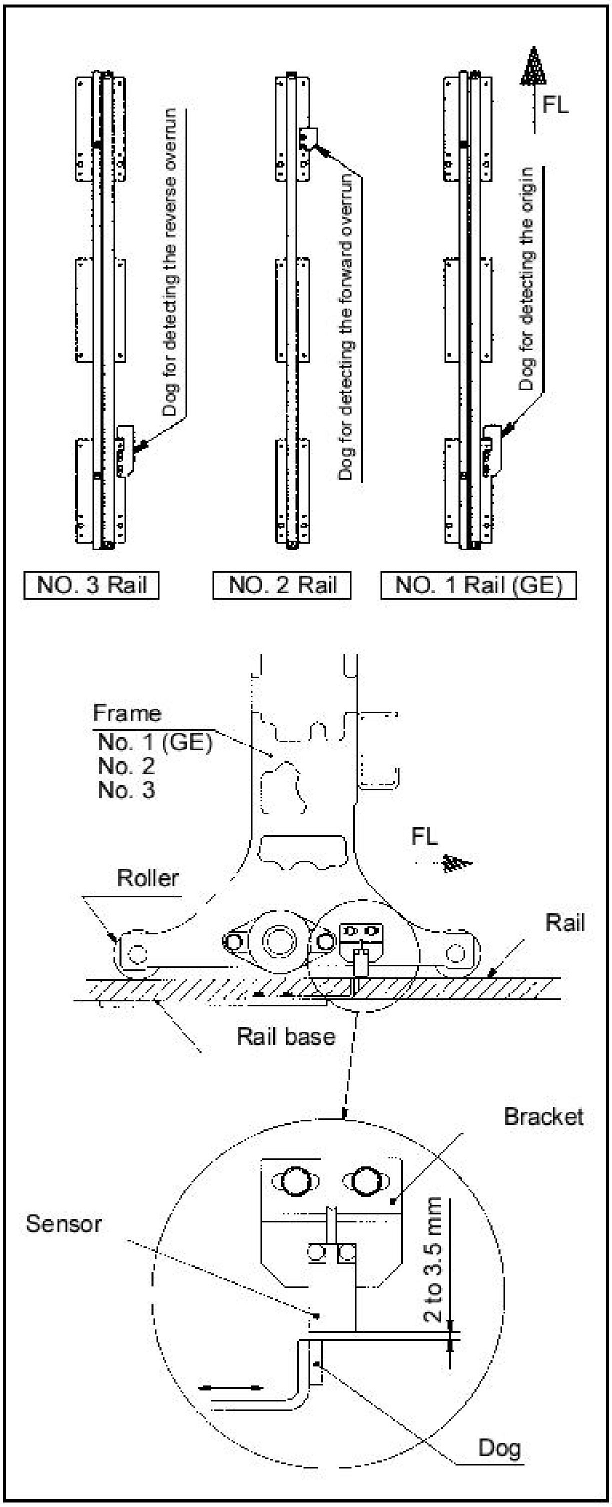
(8) Adjust the stop position C4.

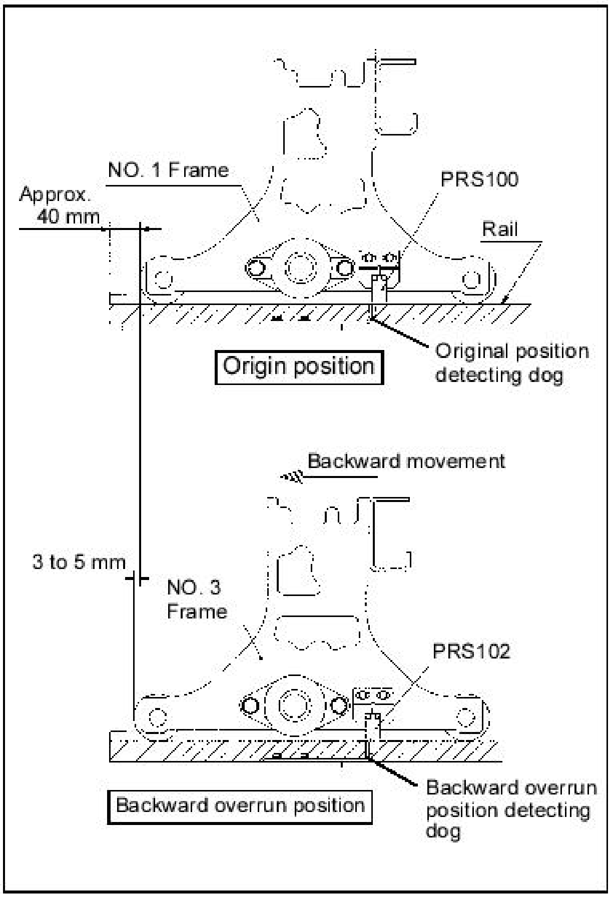
[2] Adjusting the Origin and the Forward and Reverse Overrun Positions

The origin and the forward and reverse overrun positions are determined by the installed positions of the proximity switch and the dog.

NOTES:

- Before making adjustment, check the operation of position detect switches (PRS100, 101 and 102) (see 3.3.4).
- Adjust the installation position of position detect switch and the dog in the emergency stop state.
- When making handle operation, turn the power OFF or set the machine in the emergency stop state.


Dog for detecting the reverse overrun
Dog for detecting the forward overrun
Dog for detecting the origin
FL
NO. 3 Rail
NO. 2 Rail
NO. 1 Rail (GE)
Frame
No. 1 (GE)
No. 2
No. 3
FL
Roller
Rail
Rail base
Bracket
Sensor
2 to 3.5 mm
Dog


NO. 1 Frame
Approx. 40 mm
PRS100
Rail
Origin position
Original position detecting dog
Backward movement
3 to 5 mm
NO. 3 Frame
PRS102
Backward overrun position
Backward overrun position detecting dog

(1) Adjusting the origin

1) Move the carrier by handle operation until the dimension from the carrier roller to the rail end face becomes about 40 mm.

2) Adjust the origin detect dog until the position detect switch PRS100 indicator lamp turns green (stable area).

NOTE: The detected surface of the dog should be to the left (lifter) side of the center of the position detect switch.

3) On the position change screen in the maintenance mode, advance the carrier by 200 mm toward the FL side. (See 4.1.10)

4) Press the return-to-origin button to return the carrier to the origin. (See 4.1.11)

5) Check that the dimension from the roller to the rail end face is about 40 mm.

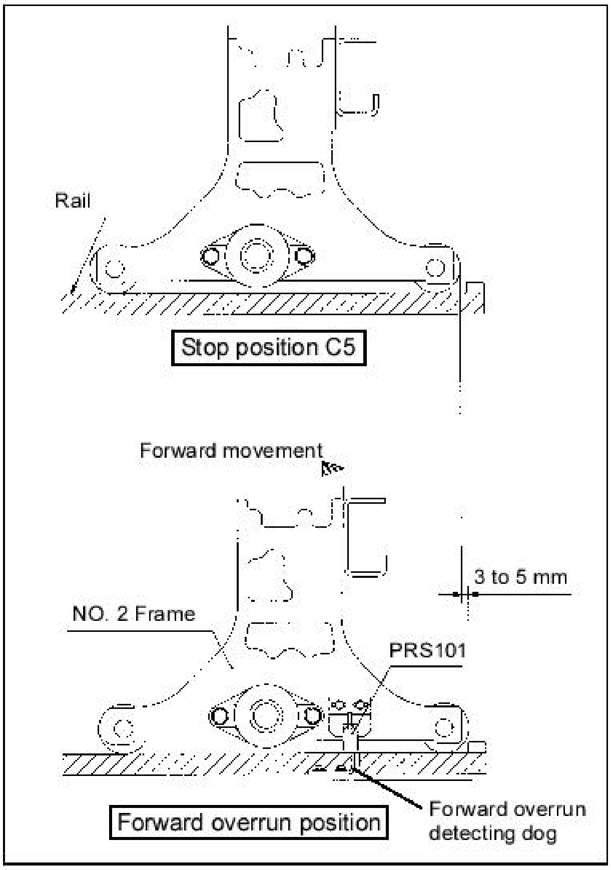
(2) Adjusting the reverse overrun position

NOTE: Carry on the adjustment after adjusting the origin.

1) Reverse the carrier 3 to 5 mm from the origin by handle operation.

2) Adjust the reverse overrun detect dog until the indicator lamp of position detect switch PRS102 turns green.

NOTE: The detected surface of the dog should be to the left (lifter) side of the center of the position detect switch.


Rail
Stop position C5
Forward movement
3 to 5 mm
NO. 2 Frame
PRS101
Forward overrun position
Forward overrun detecting dog

(3) Adjusting the forward overrun position

NOTE: Carry on the adjustment after adjusting C5. (See the next page.)

1) Move the carrier to C5 in the position transfer (see 4.1.10).

2) Advance the carrier 3 to 5 mm from C5 by handle operation.

3) Adjust the forward overrun detect dog until the indicator lamp of the position detect switch PRS101 turns green.

NOTE: The detected surface of the dog should be to the right (FL) side of the position detect switch.

[3] Adjusting Stop Positions C1 to C5

(1) Entry of initial values (preparation for adjustment)

- Before adjusting the stop position C1 to C5, enter the initial values of each stop position and the speed reduction range as the standard.
- Enter the initial value for the carrier stop position on the carrier stop position set screen. (See 4.1.16.)
- Enter the initial value for the speed reduction position on the carrier speed reduction position set screen. (See 4.1.17.)
- Adjust respective positions after entering the initial values.

NOTES:

- Always enter the set value to the table above after completing the adjustment or changing a set value.
- When entering an initial value, return the lifter and the carrier to the origin.

1. Setting the carrier stop position

Stop position	Initial value	Set value
C1	135 mm	mm
C2	239 mm	mm
C3	355 mm	mm
C4	785 mm	mm
C5	902 mm	mm
Collapsed shoulder detect section		
Start position	695 mm	mm
End position	762 mm	mm

2. Setup table for carrier speed reduction range

Speed reduction position	Initial value	Set value
C0	100 mm	mm
C1	100 mm	mm
C2	100 mm	mm
C3	100 mm	mm
C4	100 mm	mm
C5	200 mm	mm

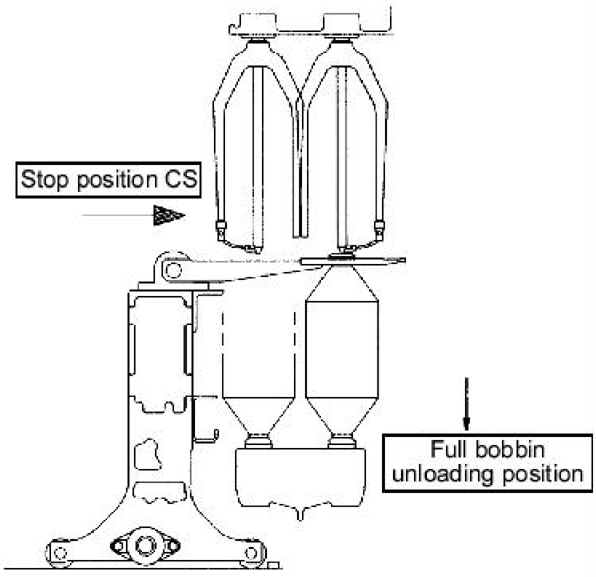
Initial value: Numerical value to be used as the standard for adjustment

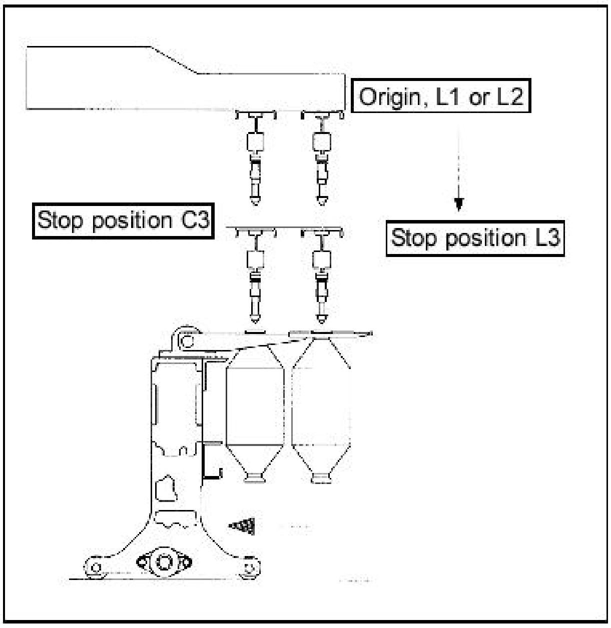
Set value: Numerical value after completing the adjustment

(2) Adjusting the stop position C5
The stop position C5 is the full bobbin unloading position from FL.

NOTE: The lifter must be at the origin or L1.

1) Lower the bobbin rail loaded with a full bobbin to the unloading position (see 4.2.2).
2) Move it to C5 by panel operation. (see 4.1.10)
3) Adjust C5 until the centers of both the full bobbin loading section of the fork and the bobbin coincide.

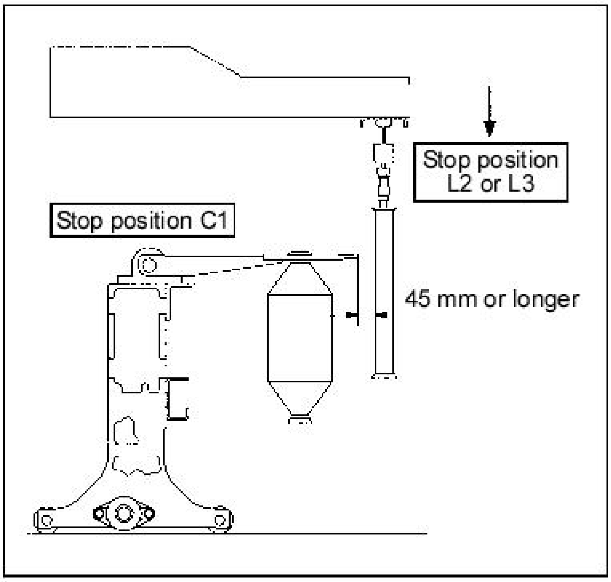



Origin, L1 or L2
Stop position C3
Stop position L3

(3) Adjusting the stop position C3
The stop position C3 is the full bobbin delivery position from the fork to the hanger.

NOTE: The lifter must be at the origin or L1 or L2.
The hanger must be free of a bobbin.

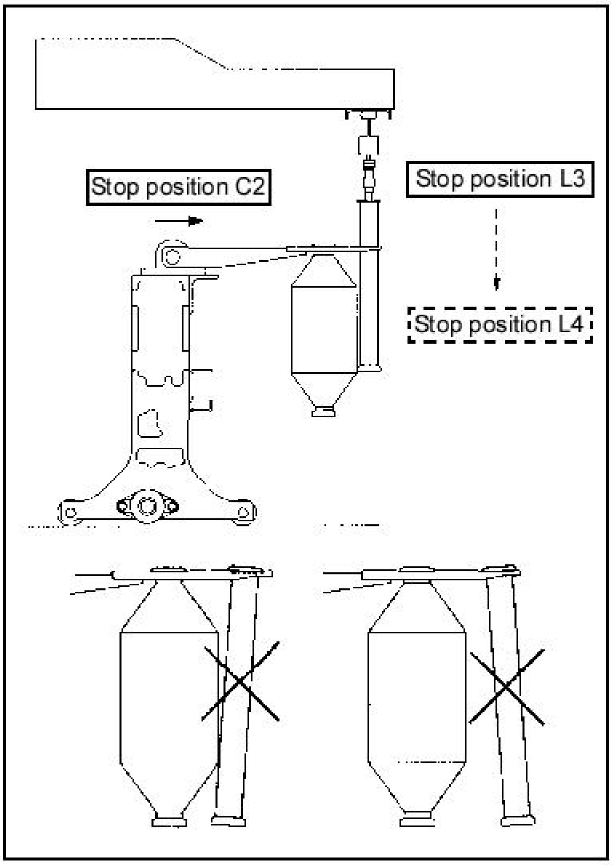
1) Move the carrier to C3 by position transfer.
2) Lower the lifter to L3.
3) Adjust C3 until the centers of the hanger and the full bobbin coincide.


Stop position L2 or L3
Stop position C1
45 mm or longer

(4) Adjusting the stop position C1
The stop position C1 is the standby position for empty bobbin delivery from a hanger to the fork.

NOTE: The lifter must stop at the origin or L1.
The hanger should be free of a bobbin.

1) Reverse the carrier to C1 by panel operation.
2) Lower the lifter to L2 or L3.
3) Hang an empty bobbin to the hanger and adjust C1 until the dimension between the bobbin and the fork end becomes 45 mm or longer.

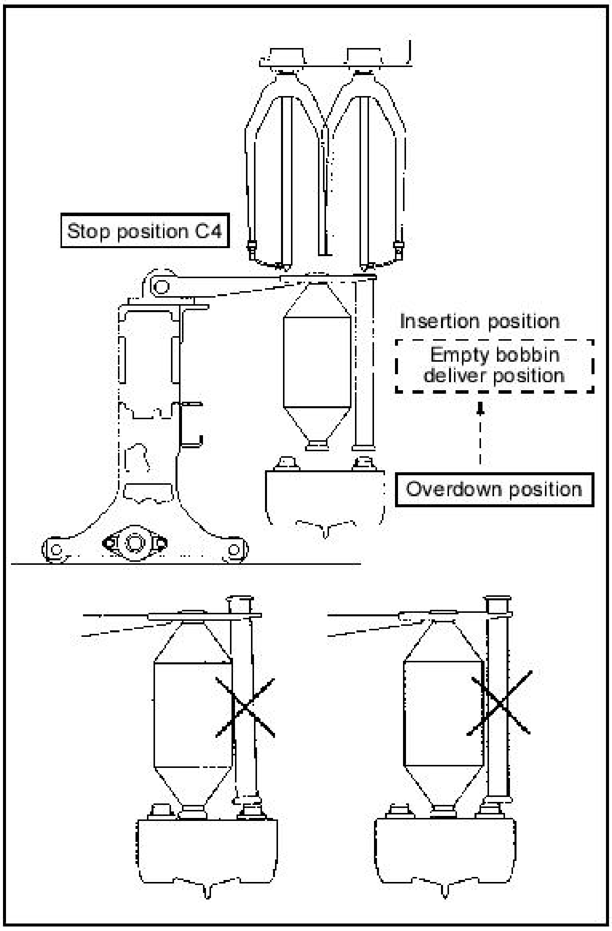

Stop position C2
Stop position L3
Stop position L4

(5) Adjusting the stop position C2
The stop position C2 is the delivery position of empty bobbin from the lifter to the fork.

NOTE: The carrier must stop at the origin or C1, and the lifter at L3.

1) Move the carrier to C2 by panel operation.
2) Adjust C2 until the centers of the empty bobbin and the empty bobbin loading section of the fork coincide.
3) Lower the lifter to L4 and switch the hanger.
4) Raise the lifter to L3 and deliver an empty bobbin to the fork.

NOTE: Check if the empty bobbin is normally delivered to the fork.


Stop position C4
Insertion position
Empty bobbin deliver position
Overdown position

(6) Adjusting the stop position C4
The stop position C4 is the delivery position of empty bobbin from the fork to FL.

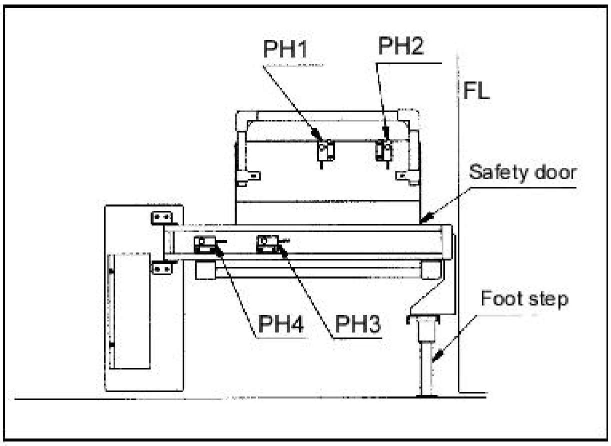
NOTES:

- The lifter must stop at the origin or L1.
- The bobbin rail must be at the overdown position.
- Before raising the bobbin rail, check that the presser is open.

1) Move the carrier to C4 by panel operation.
2) Adjust C4 until the centers of the bobbin and the bobbin wheel coincide.
3) Raise the bobbin rail to the empty bobbin insert position and deliver the empty bobbin to the FL.

NOTE: Check that empty bobbin is normally delivered t the bobbin wheel.

3.3.11 Adjusting the Delivery Error Detect Sensors



The safety door is provided with the delivery error detect sensors.
(GE side: projector, OE side: photo detector)

NOTES:

- Adjust the sensor after adjusting the installation of the safety door and foot step.
- Re-adjust the sensor if the safety door, the GE and OE foot steps are adjusted again.
- Make adjustment by each set. Turn only the sequencer output of a sensor to be adjusted. Don't turn the output of both front and the rear rows ON simultaneously. (see 4.1.20)

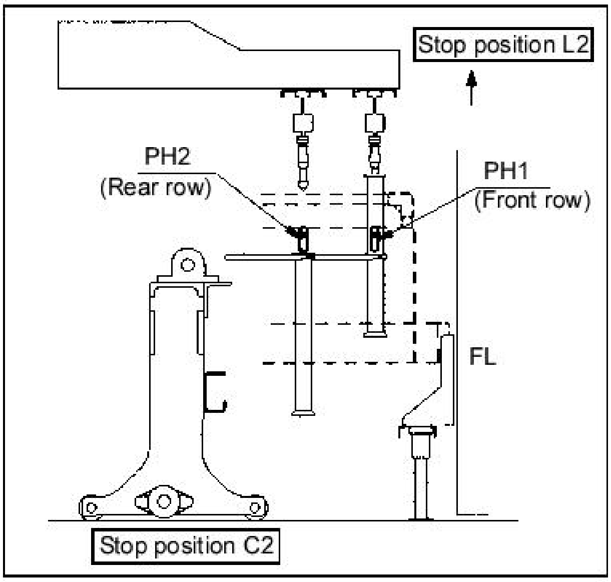
  REFERENCE: Output ports to each sensor

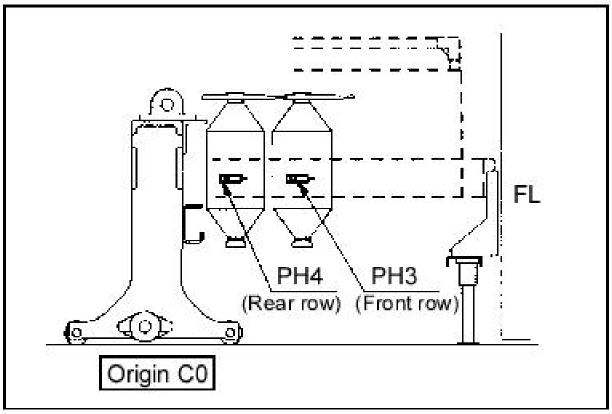
Name	Symbol	Output port
Front row, empty bobbin delivery error detection	PH1	34
Rear row, empty bobbin delivery error detection	PH2	35
Front row, full bobbin delivery error detection	PH3	36
Rear row, full bobbin delivery error detection	PH4	37

- Check the sensor operation before making adjustment. (see 3.3.4)

(1) Adjusting the empty bobbin delivery error detect sensors (PH1 and PH2)

1) Raise the carrier to C2 and move the lifter to L2.
2) Align the optical axis of the sensor.
3) Check that the optical axis is shielded by an empty bobbin hung from the hanger.
   The machine must resume the photo detecting state when the empty bobbin is removed.

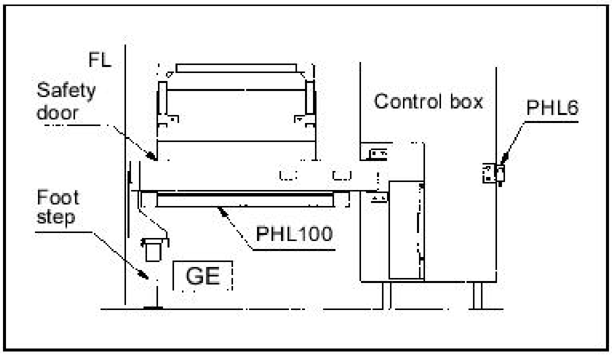



FL
PH4
(Rear row)
PH3
(Front row)
Origin C0

(2) Adjusting the full bobbin delivery error detect sensors (PH3 and PH4)

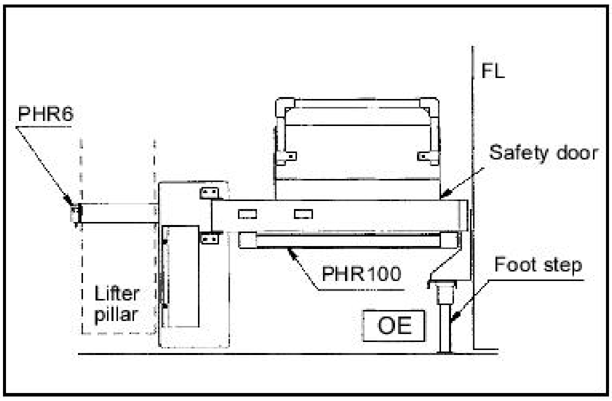
1) Move the carrier to the origin.
2) Align the optical axis of the sensor.
3) Check that the optical axis is shielded by a full bobbin hung from the fork.
   The machine must resume the photo detecting state when the full bobbin is removed.

3.3.12 Adjusting the Obstacle Detect Sensor


FL
Safety door
Foot step
Control box
PHL6
PHL100
GE

The safety door is provided with an area sensor and an entry detect sensor is installed behind the lifter pillar.

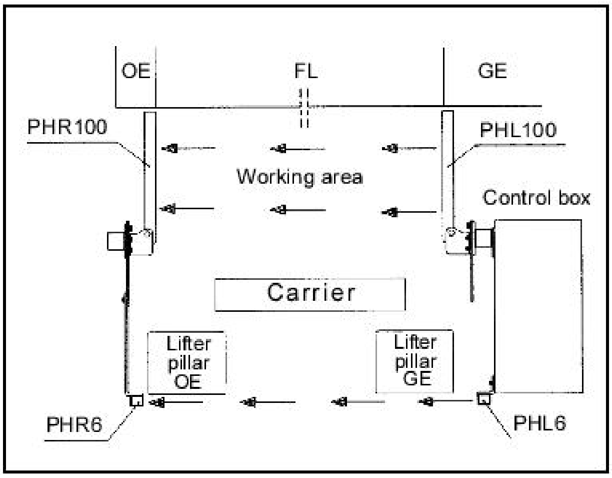
NOTE: Check the sensor operation before making adjustment. (see 3.3.4)


FL
PHR6
Safety door
Foot step
PHR100
Lifter pillar
OE

(1) Adjusting the entry detect sensor (PH6)

NOTE: Adjust the sensor after installing the pillar cover.

1) Turn the sequencer output port 39 of the entry detect sensor ON.
2) Align the optical axis.
3) Check that the optical axis is shielded when a worker traverses from behind the FRD machine.


OE
FL
GE
PHR100
PHL100
Working area
Control box
Carrier
Lifter pillar OE
Lifter pillar GE
PHR6
PHL6

(2) Adjusting the area sensor (PH100)

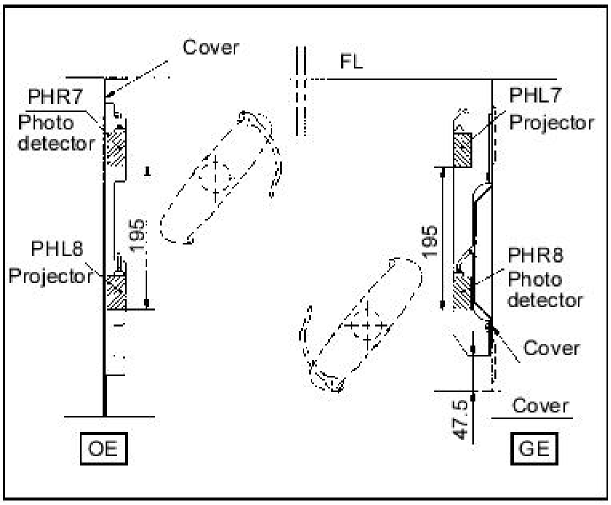
NOTES:

- Adjust the sensor after adjusting the installation of the safety door and the foot step.
- Re-adjust the sensor if the safety door, GE and OE foot steps are re-adjusted.

1) Align the optical axis.
2) Check that the optical axis is shielded when a worker is inside the working area.

NOTE: Don't stand on the foot step.

3.3.13 Adjusting the Detect Device of Bobbin with Collapsed Shoulder


Cover
FL
PHR7
Photo detector
PHL7
Projector
195
195
PHL8
Projector
PHR8
Photo detector
Cover
47.5
Cover
OE
GE

A detect device of the bobbin with collapsed shoulder is provided on the GE and OE sides of the FL with FRD specifications.

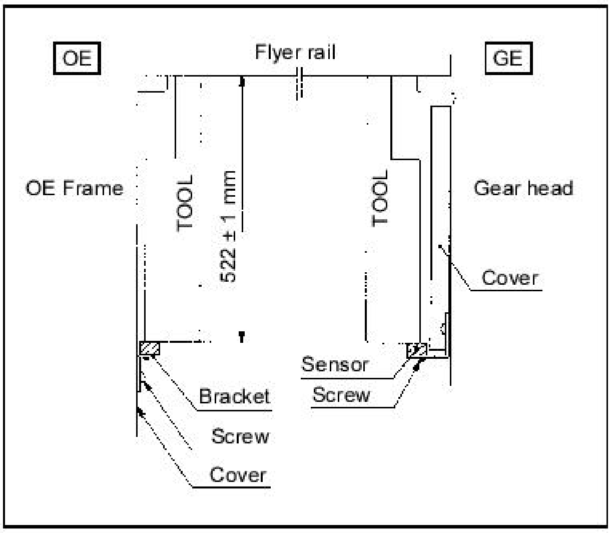
NOTES

- The fork height position should have been adjusted.
- The bobbin rail stop position should have been adjusted.
- A bobbin should be able to be placed normally on the bobbin wheel.
- No foreign matter should exist on the bobbin wheel.
- Use the bobbins specified for the FRD.
- Set the disorderly shoulder detection range after automatic operation is enabled.
- Check the sensor operation before making adjustment. (see 3.3.4)
- Sequencer output of the collapsed shoulder detect sensors on both the front and rear rows may be turned ON simultaneously.

REFERENCE:

Output port to each sensor

Name	Symbol	Output port
Rear row, bobbin with collapsed shoulder detection	PH7	3A
Front row, bobbin with collapsed shoulder detection	PH8	3B


OE
Flyer rail
GE
OE Frame
TOOL
522 ± 1 mm
TOOL
Gear head
Cover
Sensor
Screw
Bracket
Screw
Cover

(1) Sensor bracket installation

1) See that the distance from the bottom surface of the flyer rail to the upper surface of the sensor is 522 ± 1 mm.

2) Install the bracket with the illustrated dimension as the datum in the back and forth direction.

(2) Optical axis adjustment

1) Lower the bobbin rail to the full bobbin unloading position and install full bobbins on all spindles.

2) See that the light detector operation indicator lamp (red) and stabilization indicator lamp (green) of the rear row sensor (PH7) both come on. Set the sensitivity volume at the maximum position. If both the operation and stabilization indicator lamps do not come on, adjust the sensitivity volume.

3) Make fine adjustment of the rear row sensor (PH7) in the back and forth direction so that the light is shielded (only the operation indicator lamp is on) when the bobbin flange portion is pushed down by 15 to 21 mm toward the FL.

4) See that both the operation and stabilization indicator lamps of the front sensor (PH8) light detector are on.

5) Make fine adjustment of the front sensor (PH8) in the back and forth direction so that the light is shielded (only the operation indicator lamp is on) when the bobbin flange portion is pushed down by 15 to 21 mm (or more) toward the FL.

(3) Disorderly shoulder detection range setting

NOTE: Always readjust setting of the disorderly shoulder detection range after changing the sensor mounting position or the sensitivity volume (potentiometer).

1) Input 695 mm as the initial value to the start position (CS1). (See 4.1.16.)

2) Input 1,000 mm as the initial value to the end position (CS2).

3) Load empty or full bobbins on all spindles, raise the bobbin rail to the winding start position, and start automatic operation without spinning.

4) In automatic operation, the carrier stops between C4 and C5 upon detection of any bobbin with a disorderly shoulder during its movement to C5.

“Detection of disorderly shoulder bobbin” is displayed as an error message on the FRD panel. This is because disorderly shoulder bobbin detector is activated as the bolt head on the fork shields the light to the front sensor.

5) Check the stop position W by the distance from the origin on the carrier position setting screen. (See 4.1.16)

6) Input W–3 mm as the setting value for the end position (CS2) of the disorderly shoulder detection range. reference value of CS2 setting = 762 (see 4.1.16.)

7) Return all units to their hone positions and restart automatic operation. See that the carrier moves to stop position C5 and receives the bobbin from the FL. After confirmation, stop automatic operation by emergency stop operation or in any other way.

8) If the carrier stop again between C4 and C5 due to disorderly shoulder bobbin detection, repeat steps 5) to 7) above.

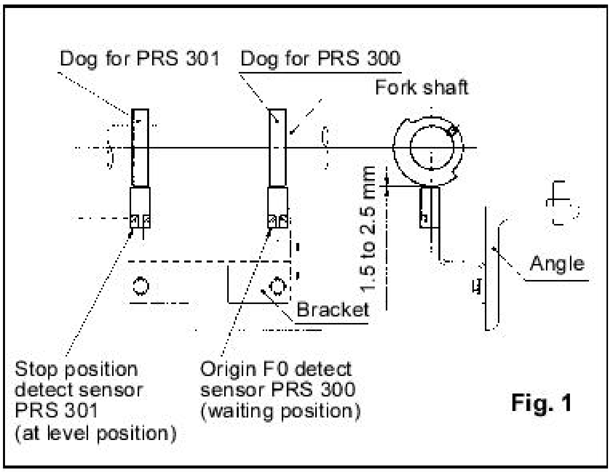
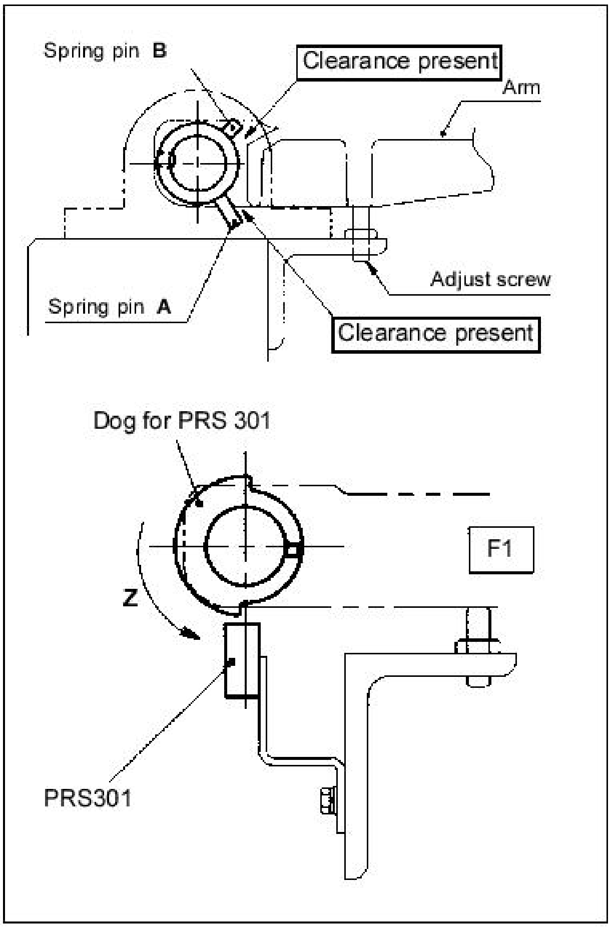

Dog for PRS 301
Dog for PRS 300
Fork shaft
1.5 to 2.5 mm
Angle
Bracket
Stop position detect sensor PRS 301 (at level position)
Origin F0 detect sensor PRS 300 (waiting position)

Fig. 1


Spring pin B
Clearance present
Arm
Adjust screw
Spring pin A
Clearance present
Dog for PRS 301
F1
Z
PRS301

3.3.14 Adjusting the Detect Device of Fork Stop Position

The stop position of the fork revolution is determined by the position of the stop position detect sensor installed on the angle and the dog installed to the fork shaft.

During the installation, the detect sensor and the dog are set as indicated in the Fig.1. If adjustment is required, follow respective stop position adjusting methods.

NOTES:

- Make adjustment after completing the adjustment of the fork height and position in the longitudinal direction.
- Make adjustment after returning the carrier and the lifter to the origin.
- Check the sensor operation before making adjustment. (see 3.3.4)

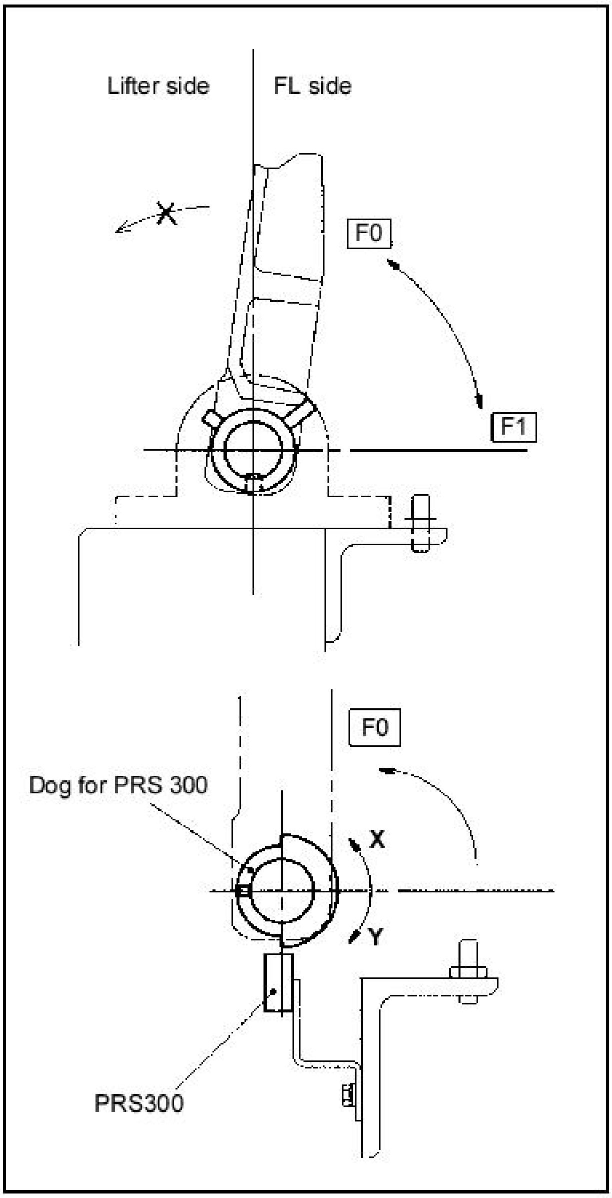
(1) Adjusting the level position F1

1) Move the fork to the level position F1 by panel operation.

2) Check that a clearance exists between the arm and the spring pins **A** and **B**.

3) If no clearance exists between the arm and the spring pins **A** and **B**, turn the dog in the direction of **Z**.

4) Rechecking the waiting position
After moving the fork to the waiting position F0 by panel operation, return it to the level position F1, and recheck clearances between the arm and spring pins **A** and **B**.



(2) Adjusting the waiting position F0

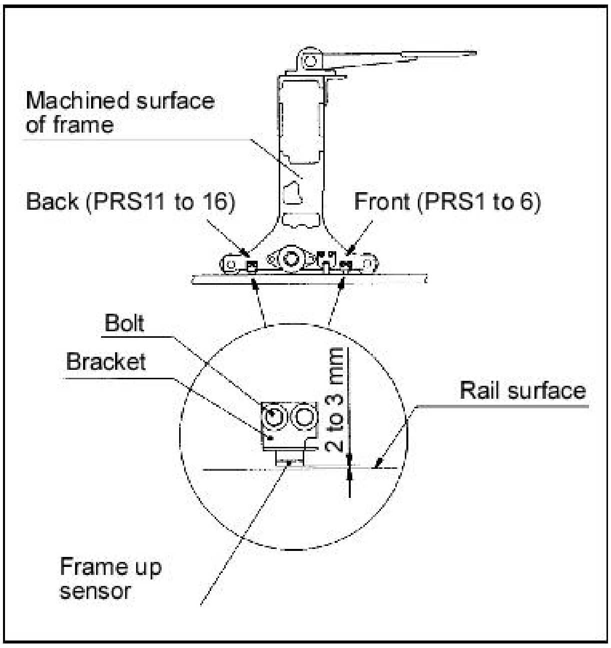
1) When the fork is at level position, move it to the origin F0 by panel operation.

2) Adjust the position of the dog.
To stop the fork at a lower position than it stops: Turn the dog in the direction of **X**.
To stop the fork at a higher position than it stops: Turn the dog in the direction of **Y**.

NOTE: Set up the arm not to fall toward the lifter.

3) Move the form by panel operation to the level position F1. Then return it to the origin F0 and re-check the stop position of the fork.

3.3.15 Adjusting the Floating Carrier Detect Device


Machined surface of frame
Back (PRS11 to 16)
Front (PRS1 to 6)
Bolt
Bracket
2 to 3 mm
Rail surface
Frame up sensor

The floating carrier detect device stops the carrier immediately upon detecting the floating of the frame when the carrier collides with an obstacle on the rail.

- The carrier frame up sensor supervises the top surface of the carrier rail with the front and rear detect sensors installed close to the travel roller (output ON state).
- This detection device can be installed to the frame with a rack.

(1) Adjusting the position
Install the device so that the clearance between the top surface of the carrier rail and the lower surface of the detect sensor will be 2 to 3 mm.

3.4 Adjusting the Bobbin Rail Stop Position

Since the FRD delivers the full and empty bobbins with the fork, it is necessary for FL of the FRD specifications to set up the FRD unloading position (full bobbin unloading position) and the FRD insert position (empty bobbin insert position).
For the entry of set values, see 4.2.1 Using the FL200 Touch Panel.

NOTE: At the factory shipment of the machine, values for the FRD unloading position and the FRD insert position are set to 2 mm as the initial values.

(1) Move the bobbin rail to the FRD unloading position and FRD insert position.

(2) Adjust the input value of the FRD unloading position and FRD insert position respectively until the dimension from the lower surface of the flyer rail to the top surface of the bobbin rail becomes 1071 mm. (see Fig. 1)

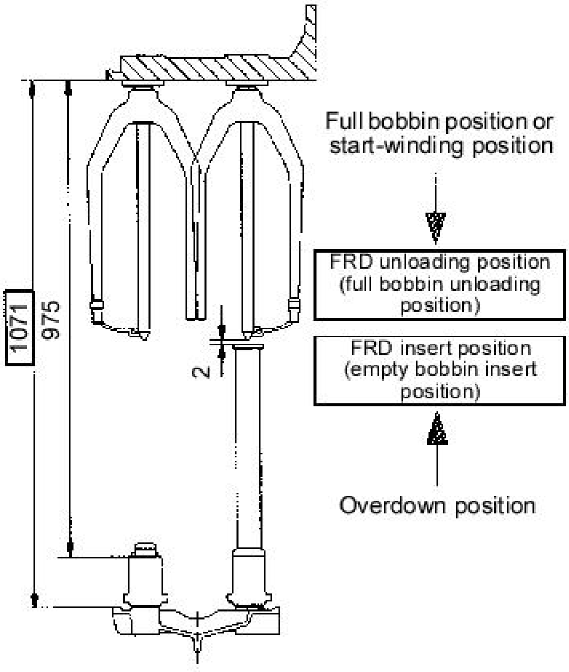
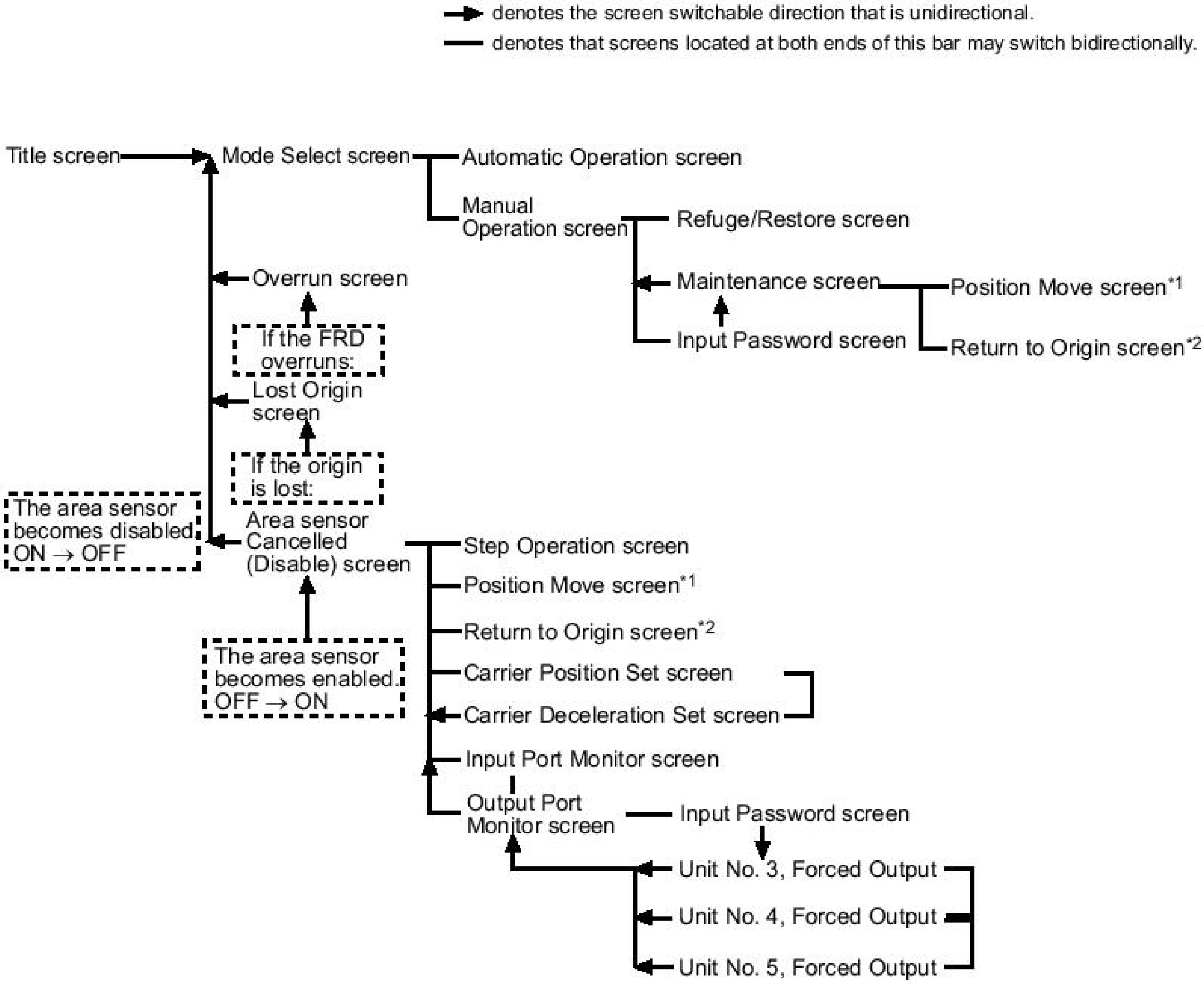

Full bobbin position or start-winding position
FRD unloading position (full bobbin unloading position)
FRD insert position (empty bobbin insert position)
Overdown position
1071
975
2

Fig. 1

4. OPERATION

4.1 FRD Operation Screens

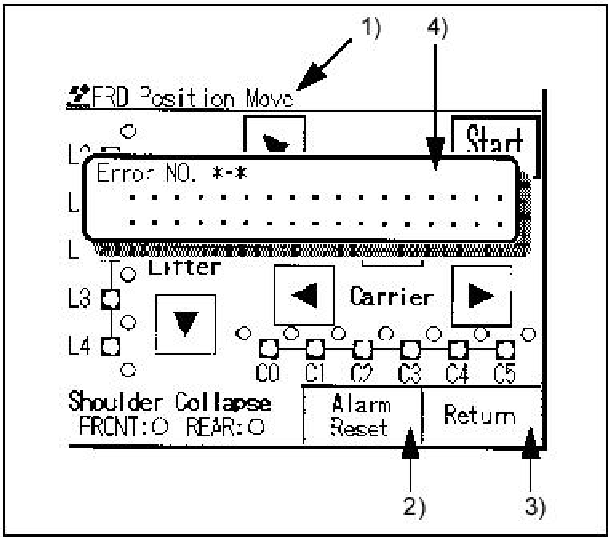
4.1.1 Screen Hierarchy on the FRD Operation Panel



denotes the screen switchable direction that is unidirectional.
denotes that screens located at both ends of this bar may switch bidirectionally.
Title screen
Mode Select screen
Automatic Operation screen
Manual Operation screen
Refuge/Restore screen
Maintenance screen
Position Move screen*1
Input Password screen
Return to Origin screen*2
Overrun screen
If the FRD overruns:
Lost Origin screen
If the origin is lost:
The area sensor becomes disabled. ON → OFF
Area sensor Cancelled (Disable) screen
Step Operation screen
Position Move screen*1
Return to Origin screen*2
Carrier Position Set screen
Carrier Deceleration Set screen
The area sensor becomes enabled. OFF → ON
Input Port Monitor screen
Output Port Monitor screen
Input Password screen
Unit No. 3, Forced Output
Unit No. 4, Forced Output
Unit No. 5, Forced Output

Screens marked with [*1] are the same "Position Move" screen.
Screens marked with [*2] are the same "Return to Origin" screen.

4.1.2 Screen Structure


1)
4)
FRD Position Move
Start
Lifter
L3
L4
Carrier
C0
C1
C2
C3
C4
C5
Shoulder Collapse
FRONT:○ REAR:○
Alarm Reset
Return
2)
3)

Error NO. *-*

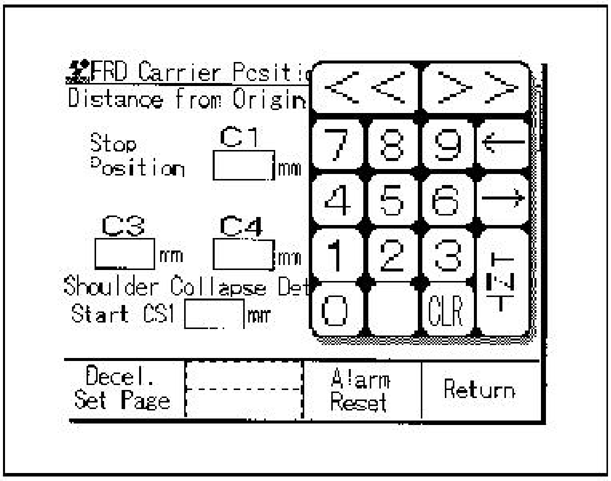
(1) Typical screen

1) Screen name

2) Alarm Reset key
Used to recover from alarm/warning states.

3) Return key
Returns to the previous screen.

4) Error message window
Upper and lower display positions selectable.


FRD Carrier Positi
Distance from Origin
Stop Position
C1
mm
C3
mm
C4
mm
Shoulder Collapse Det
Start CS1
mm
<<
>>
7
8
9
←
4
5
6
→
1
2
3
ENT
0
CLR
Decel. Set Page
Alarm Reset
Return

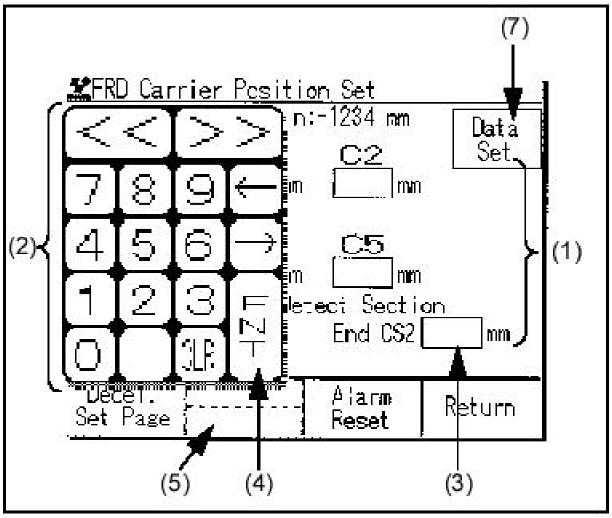
(2) Numerical keypad and arrow keys

- The numerical keypad is used to enter numerical values.
- The << and >> keys are used to move the numerical keypad. (To move it to the right, touch the >> key; to move it to the left, touch the << key. Use these keys when an item you want to access is in back of the numerical keypad.)
- The ← and → keys are used to move the cursor.

4.1.3 Data Entry and Setting Procedures

[1] Data Entry Procedure (Entering or Choosing Numerical Values)

Call up the screen which contains the item to be set. For the screen names and items, refer to Subsection 4.1.1.


(7)
FRD Carrier Position Set
<< >>
n:-1234 mm
Data Set
C2
mm
7 8 9 ←
4 5 6 →
1 2 3 ENT
0 CLR
C5
mm
Detect Section
End CS2
mm
Decel. Set Page
Alarm Reset
Return
(1)
(2)
(5)
(4)
(3)

(1) Touch the data item you want to modify. The numerical keypad appears.

(2) For those items requiring the entry of a numerical value, enter the value with the numerical keypad.

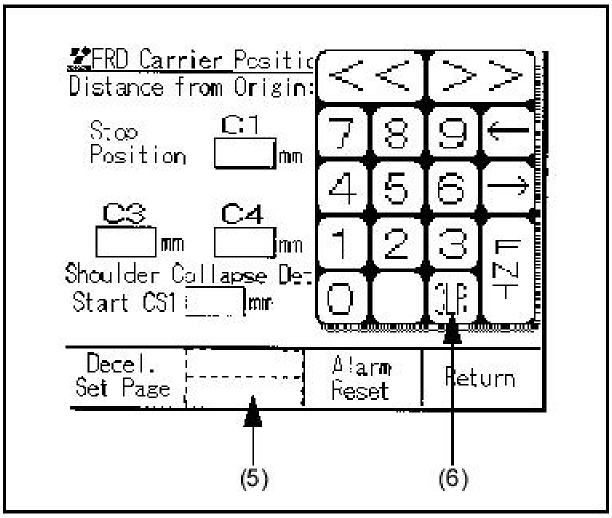
(3) The entered value appears in this area.

(4) Touch the ENT key to establish the newly entered value.

(5) In this area, the “Changing data” displays in flashing, informing you that the newly entered value is established.

NOTE: At this stage, the entered value is established only on the screen, so it is necessary to calculate the value and save the result into the memory. Refer to “[3] Data Setting Procedure.”

[2] Correcting Wrong Values Entered


FRD Carrier Positic
Distance from Origin:
Stop Position
C1
mm
C3
mm
C4
mm
Shoulder Collapse De
Start CS1
mm
<< >>
7 8 9 ←
4 5 6 →
1 2 3 ENT
0 CLR
Decel. Set Page
Alarm Reset
Return
(5)
(6)

If you have not touched the ENT key in the data entry procedure (described in [1] on the previous page), touch the CLR key to erase the wrong data. Then enter the correct value with the numerical keypad and touch the ENT key.

If you have already touched the ENT key, choose the item you want to correct, enter the correct value with the numerical keypad, and then touch the ENT key.

NOTE: When entering values with the numerical keypad, check that the value of the item you want to access is highlighted. Entry from the numerical keypad is allowed only for the highlighted item.

[3] Data Setting Procedure

After completion of data entry (in [1] above), touch the Data Set key (7) to start the data setting process. During the process, the message “Now calculating. Wait a moment.” displays.
In the process, the FRD calculates data and saves the result into the memory. Upon completion of data saving, the “Data setting complete” appears in area (5).

[4] Discarding Entered Data

You may discard entered data only if no data setting procedure has been performed.

(1) Touch the Return key, Decel. Set Page key, or Position Set Page key. The confirmation window appears.

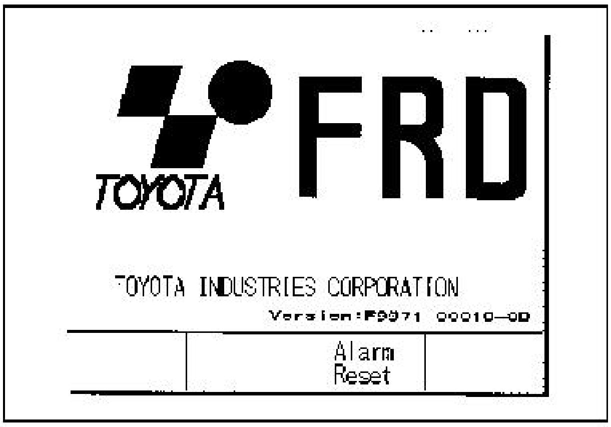
(2) In the confirmation window, touch the OK key. The entered data will be discarded.

4.1.4 Title Screen

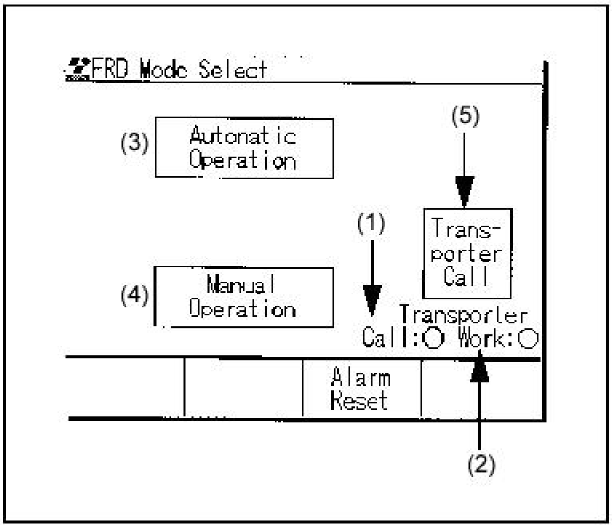
If you turn the FRD power on, the title screen will appear as shown at left. After a few seconds later, the screen will switch to either of the following ones:

(1) Mode Select screen (See Subsection 4.1.5.): if the origin has been set.

(2) Lost Origin screen (See Subsection 4.1.12.): if no origin has been set.


TOYOTA
FRD
TOYOTA INDUSTRIES CORPORATION
Version:F9971 00010-0D
Alarm
Reset

4.1.5 Mode Select Screen


FRD Mode Select
(3)
Automatic Operation
(5)
(1)
Trans-porter Call
(4)
Manual Operation
Transporter
Call:○ Work:○
Alarm Reset
(2)

(1) Call lamp

●(ON) : The FRD has completed doffing and is sending a transfer request signal to the transfer system.

○(OFF) : No transfer request signal is sent.

(2) Work lamp

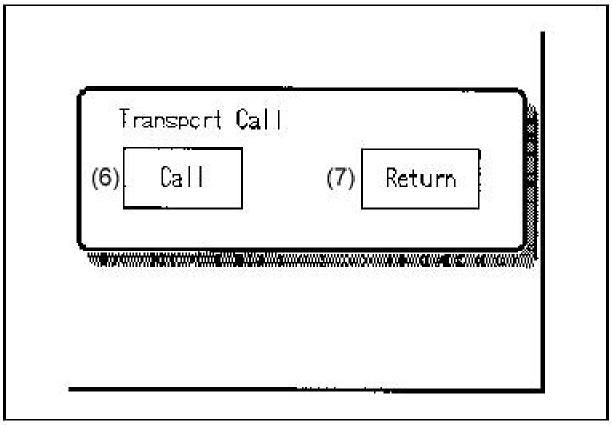
●(ON) : A transfer request signal has been registered to the transfer system. When this lamp is ON, the FRD is disabled to operate.

○(OFF) : No transfer request signal has been registered to the transfer system. When this lamp is OFF, the FRD is enabled to operate.

(3) Automatic Operation key
Switches to the Automatic Operation screen if any of the following conditions is satisfied:

- All devices are in the origin position.
- All devices are in the retracted (refuge) position.
- All devices are in automatic operation or in the restored position after retracting and restoring operations.

(4) Manual Operation key
Switches to the Manual Operation screen.
In manual operation, you may operate devices individually. Note that there are restrictions (interlocks) on movements.

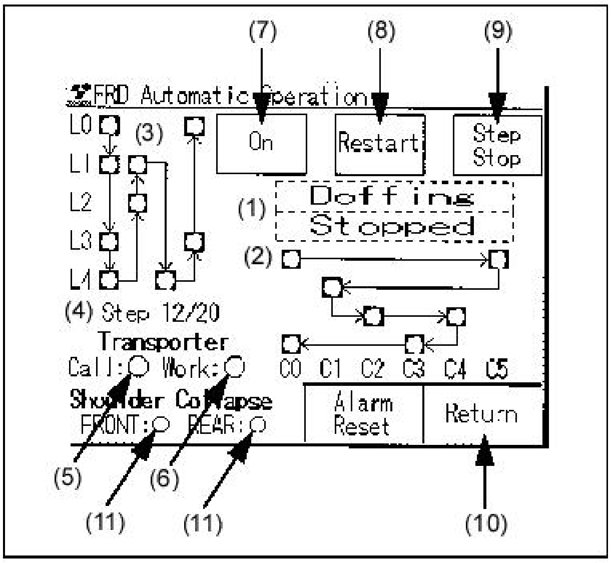

Transport Call
(6)
Call
(7)
Return

(5) Transporter Call key
Calls up the window shown at left.

(6) Call key
Outputs a transfer request signal to the transfer system.

(7) Return key
Closes the window without any operation.

4.1.6 Automatic Operation Screen



(1) Message
Shows “Doffing Now” or “Doffing Stopped” depending upon the current state.

(2) Carrier lamps
Show the carrier target position and carrier arrival position.
The carrier target position or arrival position is indicated by flashing the lamp or by turning the lamp on, respectively.

(3) Lifter lamps
Show the lifter target position and lifter arrival position.
The lifter target position or arrival position is indicated by flashing the lamp or by turning the lamp on, respectively.

(4) Step display
Shows the completed steps/all steps in automatic operation. If 0 displays, it means that the FRD is waiting for the FL to reach the full-bobbin state.

(5) Call lamp
●(ON) : The FRD has completed doffing and is sending a transfer request signal to the transfer system.
○(OFF) : No transfer request signal is sent.

(6) Work lamp
●(ON) : A transfer request signal has been registered to the transfer system. When this lamp is ON, the FRD is disabled to operate.
○(OFF) : No transfer request signal has been registered to the transfer system. When this lamp is OFF, the FRD is enabled to operate.

(7) On key
Makes the FRD enter the automatic operation mode. The FRD will wait a full-bobbin signal to be sent from the FL. This key is enabled when the stop is 0. Upon receipt of a full-bobbin signal, the FRD will start doffing.

(8) Restart key
If doffing is interrupted halfway (Step is other than 0), touching this key will restart doffing when both the following two conditions are satisfied:

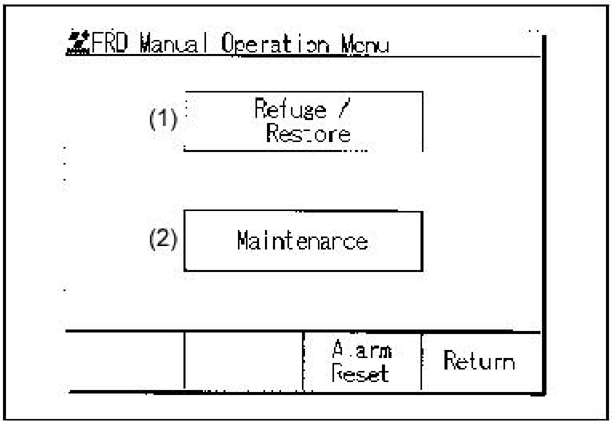
- The carrier, lifter, forks, or bobbin rail has not moved after the interruption (excluding movement involved in refuge/restore operation normally completed).
- No error has occurred (or error recovery is completed).

(9) Step Stop key
Stops doffing after completing the current step.

(10) Return key
This key will not display in automatic operation (including the FRD state where the FRD is waiting for the FL to send a doffing request signal).

(11) Shoulder Collapse detector status lamps
(When the error “E-4-1 Bobbin with deformed shoulder detected” is issued, these lamps help you learn in which row (front or rear) such a bobbin is detected.)
● : No bobbin with deformed shoulder
○ : Bobbin with deformed shoulder

4.1.7 Manual Operation Screen

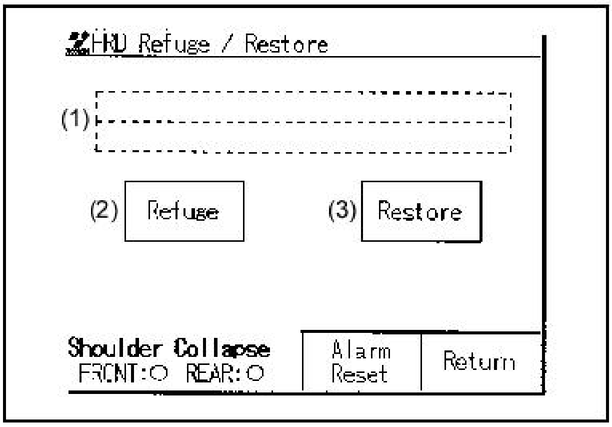

FRD Manual Operation Menu
(1)
Refuge / Restore
(2)
Maintenance
Alarm Reset
Return

(1) Refuge/Restore key
Switches to the Refuge/Restore screen where the each device moves from the automatic operation interrupted position (restored position) to the retracted (refuge) position, and vice versa.

(2) Maintenance key
Switches to the Maintenance screen where service personnel may move devices manually. Note that password entry is required. For the entry, use the numerical keypad.

4.1.8 Refuge/Restore Screen

This screen is enabled only when the carrier has stopped during transferring from C0 to C5 in automatic operation. (Refer to Subsection 5.3.3.)

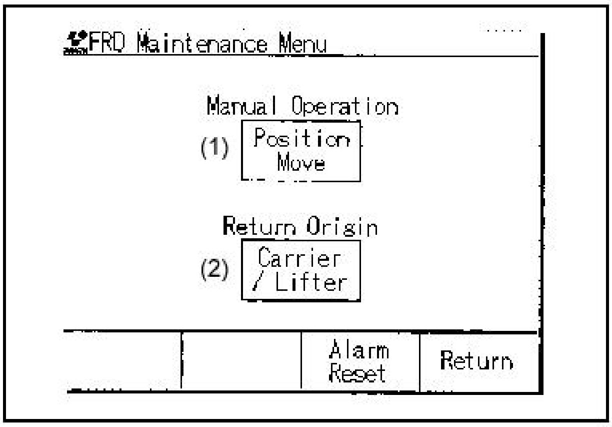

FRD Refuge / Restore
(1)
(2)
Refuge
(3)
Restore
Shoulder Collapse
FRONT:○ REAR:○
Alarm Reset
Return

(1) Message
Shows the automatic operation interrupted position (Interrupted position or restored position), the retracted (refuge) position, “Retracting now,” “Restoring now,” or “Refuge/restore prohibited.”

(2) Refuge key
Moves the devices to the retracted positions (Carrier: 03, lifter: L0, and forks: F1).

(3) Restore key
Returns the devices to the final position in Step 5.

4.1.9 Maintenance Screen

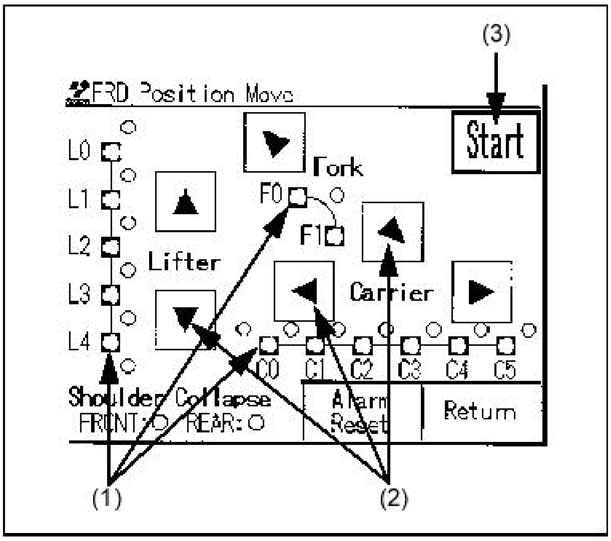

FRD Maintenance Menu
Manual Operation
(1)
Position Move
Return Origin
(2)
Carrier / Lifter
Alarm Reset
Return

■ **Manual Operation**

(1) Position Move key
Switches to the Position Move screen of devices.

■ **Return Origin**

(2) Carrier/Lifter key
Switches to the “Return to Origin” screen designed for the carrier and lifter.


(3)
FRD Position Move
Start
L0
L1
L2
L3
L4
Fork
F0
F1
Lifter
Carrier
C0 C1 C2 C3 C4 C5
Shoulder Collapse
FRONT:○ REAR:○
Alarm Reset
Return
(1)
(2)

4.1.10 Position Move Screen

(1) Lamps
The □ lamps show the stop positions of the carrier, lifter, and forks; the ○ lamps show other positions. The current positions where those devices are located are shown by lighting □ or ○; the target positions are shown by flashing □.

(2) ◀▶, ▲▼, ▶◀ arrow keys
Touching each arrow key will move the target position (indicated by flashing □) of each device (◀▶: carrier, ▲▼: lifter, ▶◀: forks) in the direction of the arrow key.

If the carrier reaches the specified target position (the current position becomes equal to the target position), for example, the flashing □ lamp will stop flashing and come to stay on.

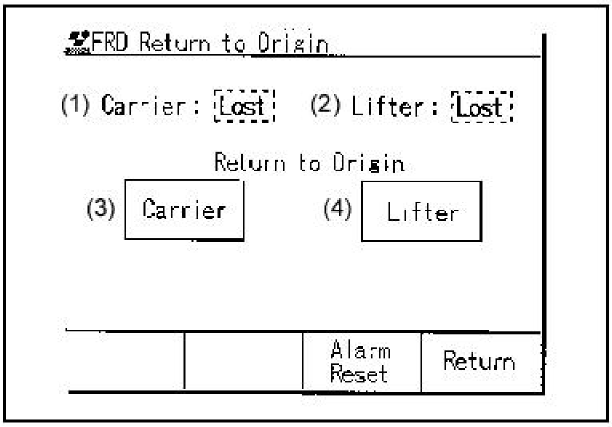
In manual operation, you cannot move the carrier, lifter, and forks concurrently; any one of them may move. When the target position of a particular device is shown, any other device cannot move. If you attempt to move it by pressing the arrow key, an alarm message will appear.

(3) Start key
Touching this key when the target position of any device is specified will move that device to the target position; touching it when no target position is specified will produce nothing.

NOTE: When the forks hold bobbins, never move the forks.

4.1.11 Return to Origin Screen

If the carrier does not lie at the origin position when the power is turned on or if the current carrier position becomes indefinite due to a lifter sensor error or other errors, then the current screen will automatically switch to this Lost Origin screen.

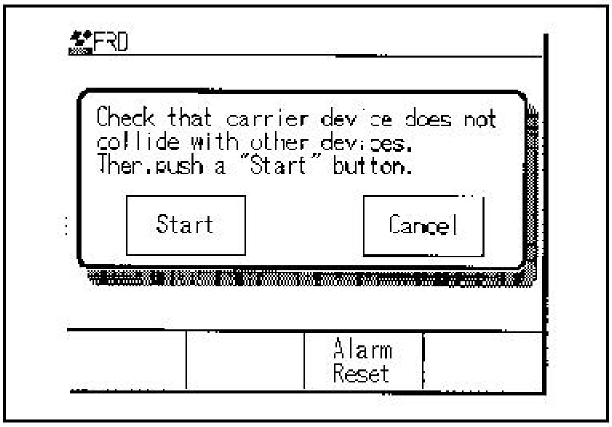


FRD Return to Origin

(1) Carrier: Lost (2) Lifter: Lost

(1) Carrier message
Shows “Set” if the carrier origin position has been set; shows “Lost” if it has not.

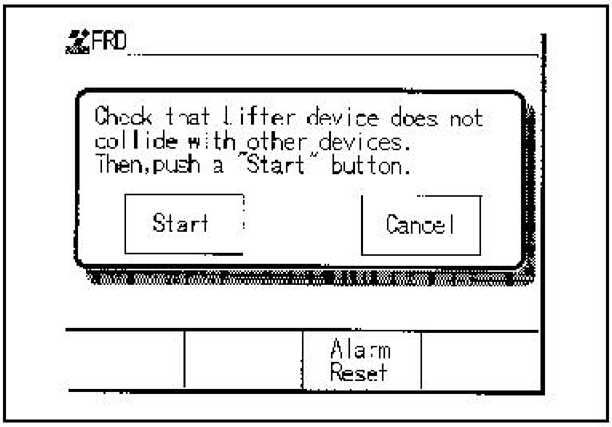
(2) Lifter message
Shows “Set” if the lifter origin position has been set; shows “Lost” if it has not.



FRD

Check that carrier device does not collide with other devices.
Then,push a "Start" button.

(3) Carrier key
Pressing this key will call up the confirmation message shown at left. Press “Start” to return the carrier to the origin position.

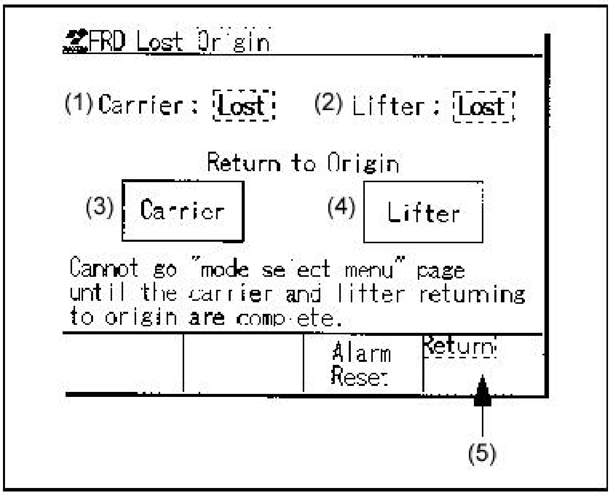


FRD

Check that lifter device does not collide with other devices.
Then,push a "Start" button.

(4) Lifter key
Pressing this key will call up the confirmation message shown at left. Press “Start” to return the lifter to the origin position.

NOTE: Origin positions will be automatically set upon completion of origin restoring operation.



(1) Carrier : Lost (2) Lifter : Lost

Cannot go "mode select menu" page until the carrier and lifter returning to origin are complete.

4.1.12 Lost Origin Screen

If the carrier does not lie at the origin position when the power is turned on or if the current carrier position becomes indefinite due to a lifter sensor error or other errors, then the current screen will automatically switch to this Lost Origin screen.

(1) Carrier message
Shows “Set” if the carrier origin position has been set; shows “Lost” if it has not.

(2) Lifter message
Shows “Set” if the lifter origin position has been set; shows “Lost” if it has not.

(3) Carrier key
Returns the carrier to the origin position.

(4) Lifter key
Returns the lifter to the origin position.

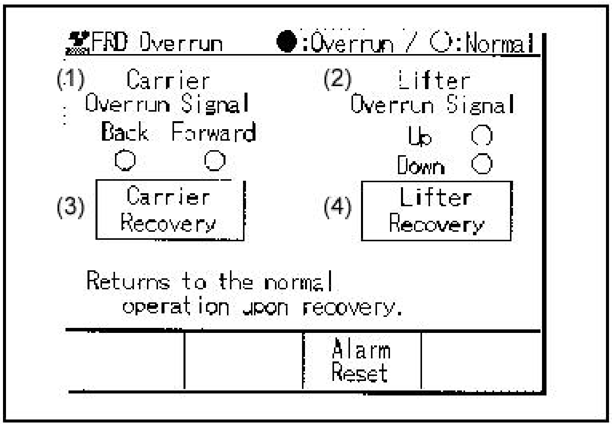
(5) Return key
This key will appear after both the carrier and lifter have returned to their origin positions. Pressing this key switches back to the Mode Select screen.

NOTE: Origin positions will be automatically set upon completion of origin restoring operation.

4.1.13 Overrun Screen

If the FRD controller detects carrier or lifter overrun, it will automatically switch the current screen to one shown at left.

Recovering from the overrun state will return the screen to the Mode Select screen (or Lost Origin screen or Area Sensor Cancelled screen).


FRD Overrun
●:Overrun / ○:Normal
(1)
Carrier
Overrun Signal
Back
Forward
○ ○
(2)
Lifter
Overrun Signal
Up ○
Down ○
(3)
Carrier Recovery
(4)
Lifter Recovery
Alarm Reset

Returns to the normal operation upon recovery.

(1) Carrier Overrun Signal
Goes on only when the carrier has overrun.
If an overrun signal is received, either of the overrun lamps will come on (●).

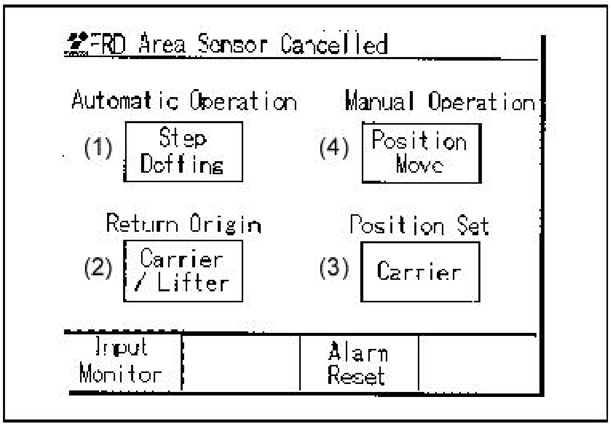
(2) Lifter Overrun Signal
Goes on only when the lifter has overrun.
If an overrun signal is received, either of the overrun lamps will come on (●).

(3) Carrier Recovery key
Appears only when the carrier has overrun.
If the carrier has overrun backwards or forwards, touching this key will rotate the motor at Speed 1 for one second to move the carrier to the front or rear, respectively.

(4) Lifter Recovery key
Appears only when the lifter has overrun.
If the lifter has overrun upwards or downwards, touching this key will rotate the motor at Speed 1 for one second to move the lifter down or up, respectively.

4.1.14 Area Sensor Cancelled Screen

This screen will appear if you enable the area sensor key switch.


FRD Area Sensor Cancelled
Automatic Operation
(1)
Step Doffing
Manual Operation
(4)
Position Move
Return Origin
(2)
Carrier / Lifter
Position Set
(3)
Carrier
Input Monitor
Alarm Reset

- **Automatic Operation**

(1) Step Doffing key
Switches to the Step Operation screen only when step doffing is possible.

- **Return Origin**

(2) Carrier/Lifter key
Switches to the Return to Origin screen designed for the carrier and lifter.

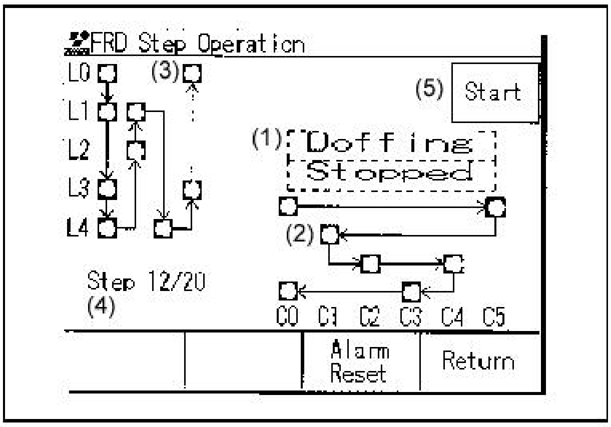
- **Position Set**

(3) Carrier key
Switches to the Carrier Position Set screen.

- **Manual Operation**

(4) Position Move key
Switches to the Position Move screen where you may move the carrier, lifter, and forks.

4.1.15 Step Operation Screen


FRD Step Operation
L0
L1
L2
L3
L4
(3)
(5)
Start
(1)
Doffing
Stopped
(2)
Step 12/20
(4)
C0 C1 C2 C3 C4 C5
Alarm Reset
Return

(1) Message
Shows “Doffing Now” when the FRD is executing a step of automatic doffing operation and shows “Doffing Stopped” after completion of the step of doffing.

(2) Carrier lamps
Show the carrier target position and carrier arrival position.
The carrier target position or arrival position is indicated by flashing the lamp or by turning the lamp on, respectively.

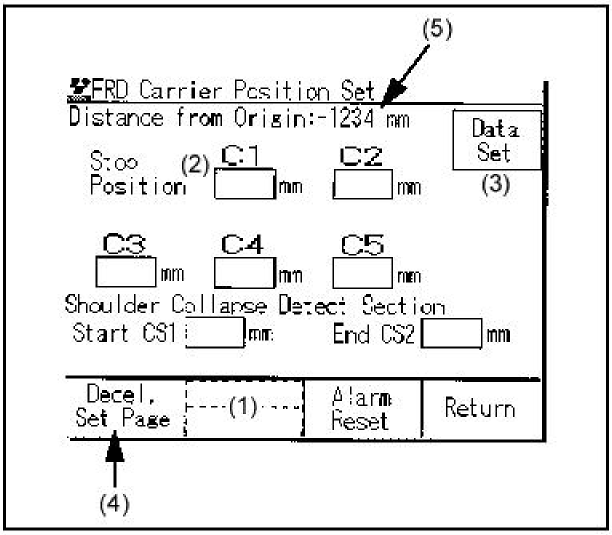
(3) Lifter lamps
Show the lifter target position and lifter arrival position.
The lifter target position or arrival position is indicated by flashing the lamp or by turning the lamp on, respectively.

(4) Step display
Shows the completed steps. If 0 displays, it means that the FRD is waiting for the **FL** to reach the full-bobbin state.

(5) Step key
Displays only when the step operation is possible. After completion of doffing in step operation, this key cannot display.
Touching this key will run the FRD in step operation.

4.1.16 Carrier Position Set Screen

The Carrier Position Set screen shows the numerical values preset to the stop positions and shoulder collapse detection section.



FRD Carrier Position Set

Distance from Origin:-1234 mm

(1) “Changing data”/“Data setting complete” display
If you access any of the numerical values shown on this screen, the “Changing data” appears in this area. If the newly entered value is correctly set, the “Data setting complete” appears. (When this screen is called up, this area shows nothing.)

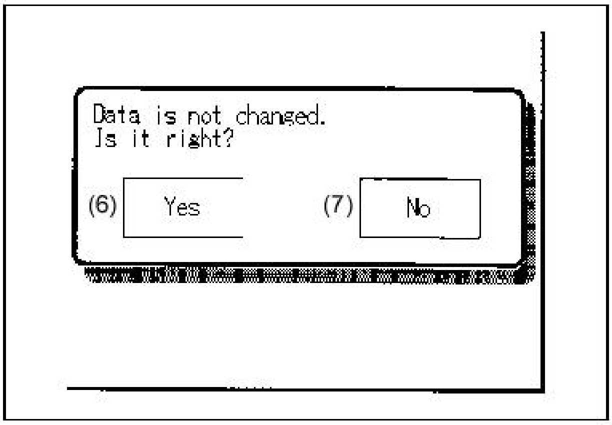
(2) (Numerical values)
To modify numerical values, touch the value to be modified. The numerical keypad appears where you may enter values.

(3) Data Set key
Establishes the newly entered value(s). If either of the following conditions is not satisfied, an error will result:

- Value for C1 ≤ Value for C2 ≤ Value for C3 ≤ Value for C4 ≤ Value for C5
- Start of shoulder collapse detect section (SCDS) ≤ End of SCDS ≤ Value for C5

(4) Decel. Set Page key
Switches to the Carrier Deceleration Set screen.

(5) Top area
Displays the current carrier position.



Data is not changed.
Is it right?

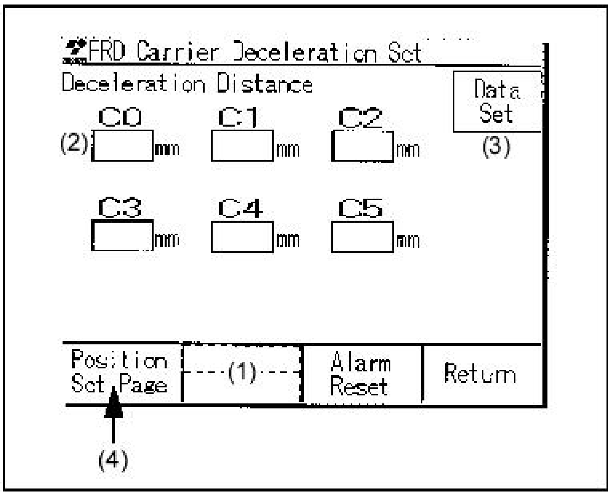
If you touch the Return or Decel. Set Page key without establishing the entered value(s), the confirmation message window will appear as shown at left.

NOTE: When the screen switches, entered data not yet established will be discarded.

(6) Yes
Discards entered data and switches the screen.

(7) No
Produces nothing and erases the confirmation message window.

4.1.17 Carrier Deceleration Range Set Screen

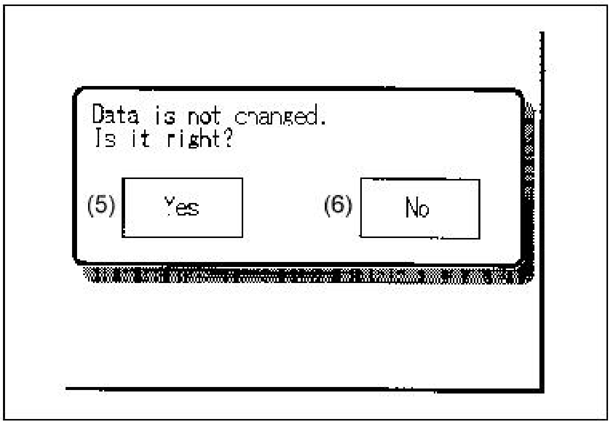

FRD Carrier Deceleration Set
Deceleration Distance
C0
C1
C2
C3
C4
C5
mm
Data Set
Position Set Page
Alarm Reset
Return
(1)
(2)
(3)
(4)

(1) "Changing data"/"Data setting complete" display
If you access any of the numerical values shown on this screen, the "Changing data" appears in this area. If the newly entered value is correctly set, the "Data setting complete" appears. (When this screen is called up, this area shows nothing.)

(2) (Numerical values)
To modify numerical values, touch the value to be modified. The numerical keypad appears where you may enter values.
Deceleration values refer to the distance from the stop position to the deceleration start position.

(3) Data Set key
Saves the newly entered value(s) to the sequencer.

(4) Position Set Page key
Switches to the Carrier Position Set screen.

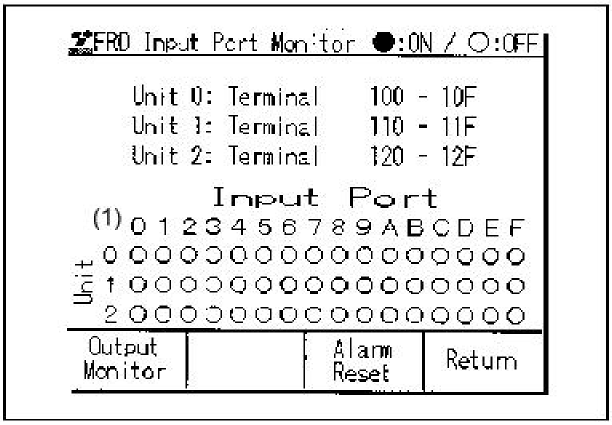

Data is not changed.
Is it right?

If you touch the Return or Position Set Page key without establishing the entered value(s), the confirmation message window will appear as shown at left.

NOTE: When the screen switches, entered data not yet established will be discarded.

(5) Yes
Discards entered data and switches the screen.

(6) No
Produces nothing and erases the confirmation message window.



FRD Input Port Monitor ●:ON / ○:OFF

Unit 0: Terminal 100 - 10F
Unit 1: Terminal 110 - 11F
Unit 2: Terminal 120 - 12F

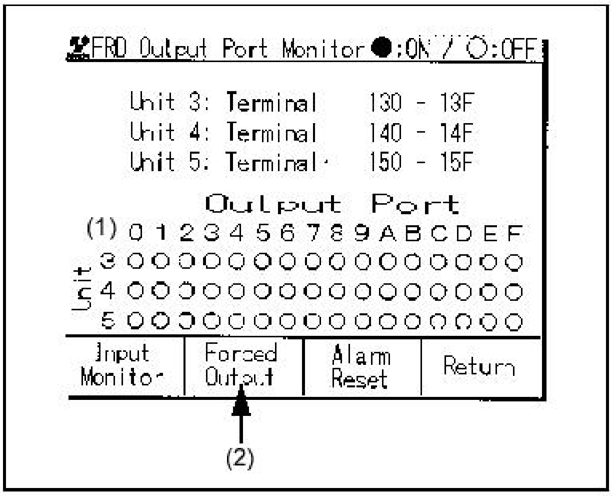
Input Port

Unit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

(1)
Output Monitor
Alarm Reset
Return

4.1.18 Input Port Monitor Screen

(1) Input Port states
Show the ON/OFF state of each input port.
If input is ON, the lamp goes on (●); if OFF, it goes off (○).



FRD Output Port Monitor ●:ON / ○:OFF

Unit 3: Terminal 130 - 13F
Unit 4: Terminal 140 - 14F
Unit 5: Terminal 150 - 15F

Output Port

Unit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

(1)
Input Monitor
Forced Output
Alarm Reset
Return
(2)

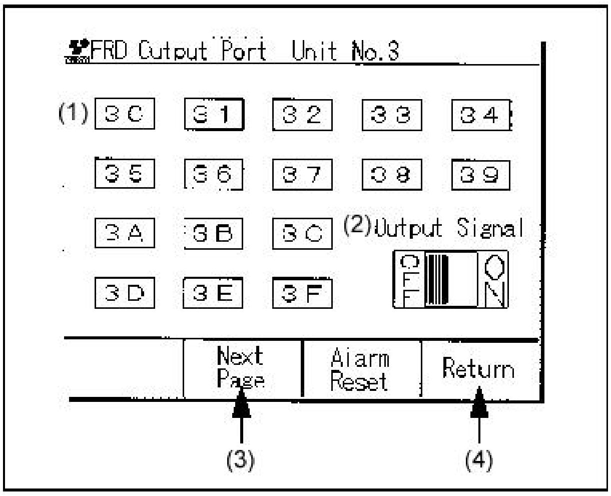
4.1.19 Output Port Monitor Screen

(1) Output Port states
Show the ON/OFF state of each output port.
If output is ON, the lamp goes on (●); if OFF, it goes off (○).

(2) Forced Output key
Switches to the forced output screen “Output Port Unit No. 3." Note that password entry is required. For the entry, use the numerical keypad.

4.1.20 Forced Output Screens

[1] Output Port Unit No. 3 Screen


FRD Output Port Unit No.3
(1)
3 C
3 1
3 2
3 3
3 4
3 5
3 6
3 7
3 8
3 9
3 A
3 B
3 C
(2)Output Signal
3 D
3 E
3 F
OFF
ON
Next Page
Alarm Reset
Return
(3)
(4)

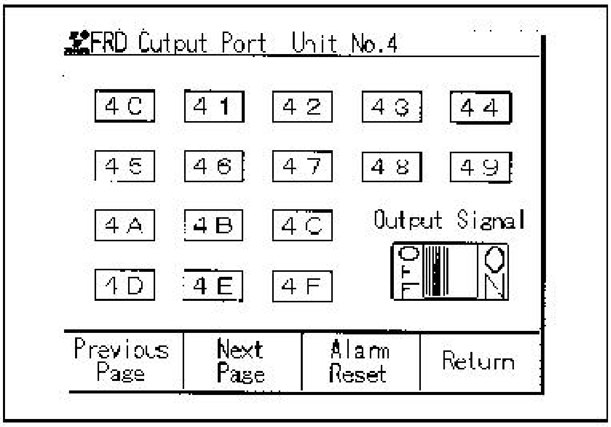
(1) Port numbers keys
Touching each key switches its output to ON (selected) or OFF (deselected). When this screen is called up, all output ports are deselected.

(2) Output Signal ON/OFF switch
Turning this switch ON will output the states of output ports (Units 3 to 5) which are selected.

(3) Next Page key
Switches to the forced output screen “Output Port Unit No.4.”

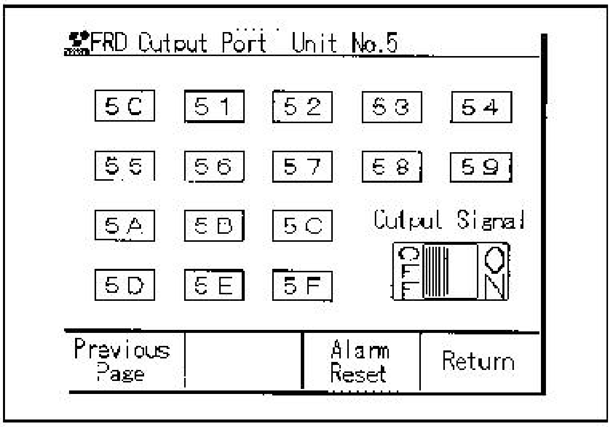
(4) Return key
Switches back to the Output Port Monitor screen.

[2] Output Port Unit No. 4 Screen


FRD Output Port Unit No.4
4 C
4 1
4 2
4 3
4 4
4 5
4 6
4 7
4 8
4 9
4 A
4 B
4 C
Output Signal
4 D
4 E
4 F
OFF
ON
Previous Page
Next Page
Alarm Reset
Return

Description in [1] may apply.

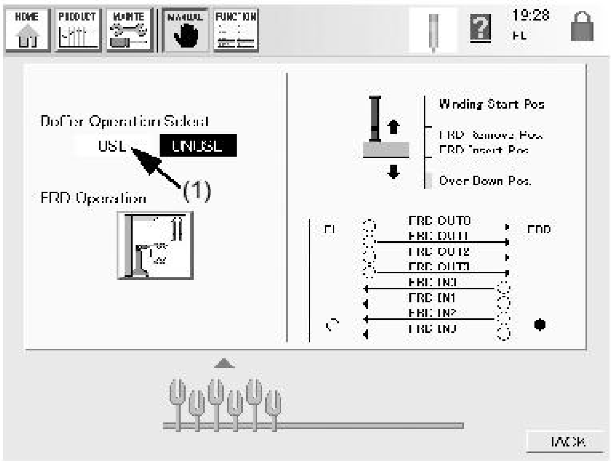
[3] Output Port Unit No. 5 Screen


FRD Output Port Unit No.5
5 C
5 1
5 2
5 3
5 4
5 5
5 6
5 7
5 8
5 9
5 A
5 B
5 C
Output Signal
5 D
5 E
5 F
OFF
ON
Previous Page
Alarm Reset
Return

Description in [1] may apply.

4.2 FL200 Operation

4.2.1 Using the FL200 Touch Panel



Doffer Operation Select

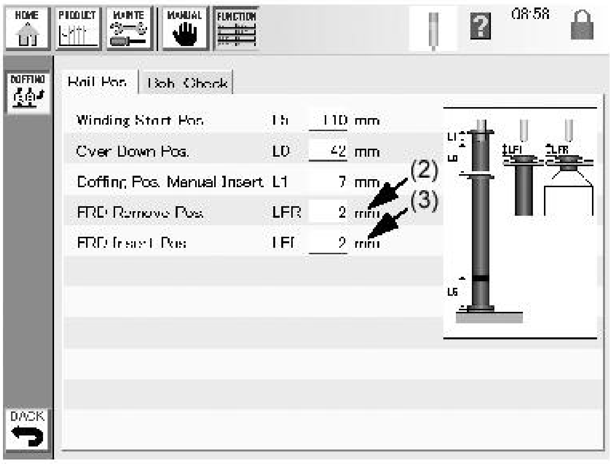
USE UNUSE

FRD Operation

HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
19:28
FL
(1)
Winding Start Pos
FRD Remove Pos
FRD Insert Pos
Over Down Pos.
FL
FRD
FRD OUT0
FRD OUT1
FRD OUT2
FRD OUT3
FRD IN0
FRD IN1
FRD IN2
FRD IN3
BACK

(1) Doffer
Choose “USE” or “UNUSE.” Selecting “USE” may put restrictions on bobbin rail movement and allow the bobbin rail to be interrupted during automatic doffing.

REFERENCE: If “UNUSE” is selected, the FL200 works same way as FL200 not supporting the doffer.



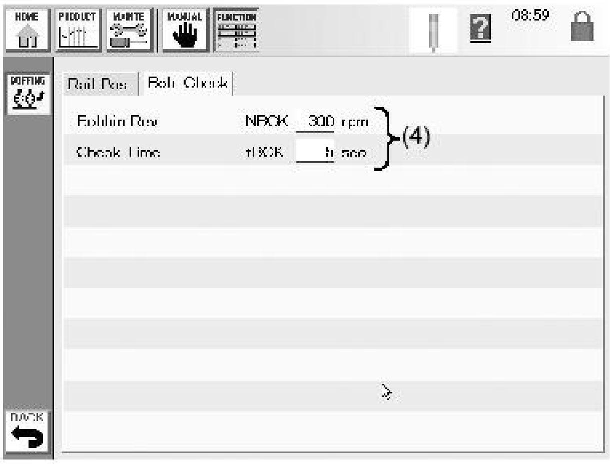
Winding Start Pos.	LS	110	mm
Over Down Pos.	LD	42	mm
Doffing Pos. Manual Insert	L1	7	mm
FRD Remove Pos.	LFR	2	mm
FRD Insert Pos.	LFI	2	mm

HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
08:58
DOFFING
Rail Pos.
Bob. Check
(2)
(3)
L1
LD
LFI
LFR
LS
BACK

(2) FRD Remove Pos.
Shows the full-bobbin unloading position.

(3) FRD Insert Pos.
Shows the empty-bobbin loading position.
You may set the full-bobbin unloading position and empty-bobbin loading position.

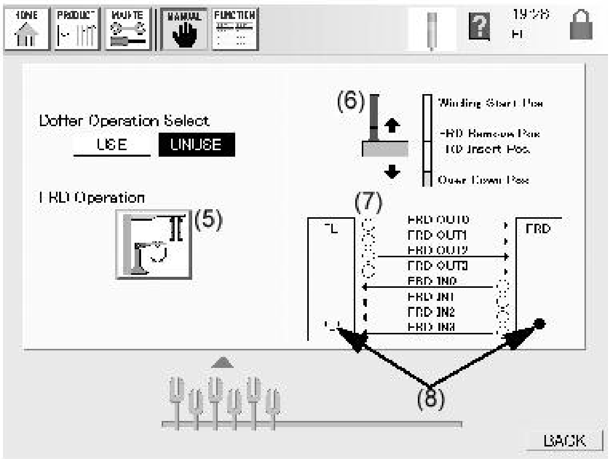
NOTE: For the empty bobbin loading position and full bobbin unloading position, input the distance from the top of the spindle.



Bobbin Rev	NBCK	300	rpm
Check Time	tBCK	5	sec

HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
08:59
DOFFING
Rail Pos.
Bob. Check
(4)
BACK

(4) Bobbin loading error detection
The bobbin loading state is checked by rotating the bobbin as it rises from the empty bobbin loading position to the winding start position.
Input the “Bobbin Rev” and “Check Time”.


HOME
PRODUCT
MAINTE
MANUAL
FUNCTION
19:28
FL
Doffer Operation Select
USE
UNUSE
FRD Operation
(5)
(6)
Winding Start Pos
FRD Remove Pos
FRD Insert Pos
Over Down Pos
(7)
FL
FRD
FRD OUT0
FRD OUT1
FRD OUT2
FRD OUT3
FRD IN0
FRD IN1
FRD IN2
FRD IN3
(8)
BACK

(5) Doffing Start SW
Starts forced automatic FRD doffing. When the FL is on halt due to full-bobbin, pressing this switch will operate the FL together with the FRD the same way as usual full-bobbin doffing.
This switch is also used to manually travel the FRD. This is because pressing this switch when the FL is on halt due to full-bobbin will turn the “FRD call” signal ON so that you may travel the FRD. (When the “FRD call” signal is OFF, no FRD travel or return-to-origin movement is possible. Refer to Subsection 5.3.13.)

(6) Bobbin Rail Position lamps
Each lamp comes on when the bobbin rail reaches the corresponding position out of the total six positions--the winding start position, full-bobbin unloading position, empty-bobbin loading position, overdown position, and their inbetween positions.

(7) Signal monitor lamps
Show the status of signals being exchanged between the FL and FRD. Note that at the time of initial signal check, these lamps may not show the signal status depending upon the monitor updating intervals.

- Signals from FL to FRD

  FRD OUT 0: Command 1
  FRD OUT 1: Command 2
  FRD OUT 2: FRD call signal
  FRD OUT 3: Permission signal

- Signals from FRD to FL

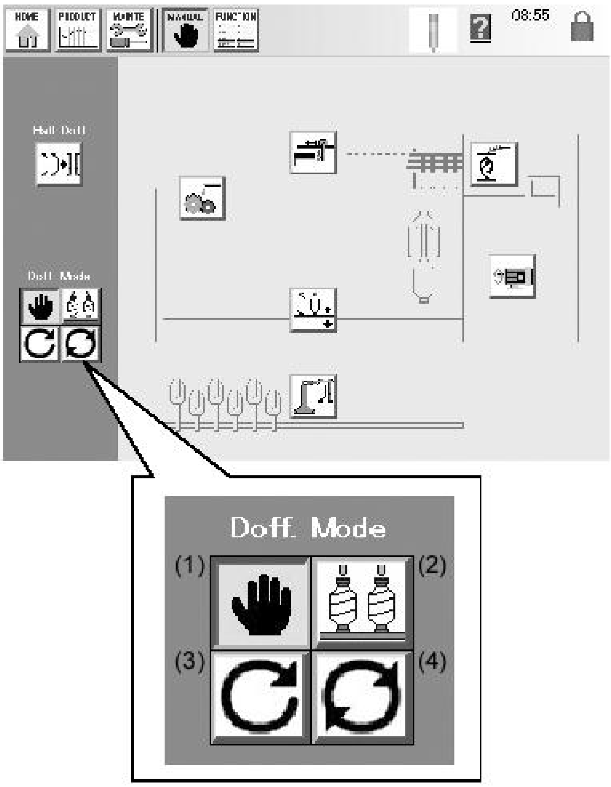
  FRD IN 0: Command 1
  FRD IN 1: Command 2
  FRD IN 2: Operating signal
  FRD IN 3: Permission signal

REFERENCE: See 5.3.15 for the details of each signal.

(8) Initial signal monitor lamps
At the FL200, the lamp comes on if the FL200 receives an initial signal sent from the FRD.
At the FRD, the lamp comes on if the FRD receives it from the FL200.

4.2.2 Using the FL200 Switches

[1] Doffing Automatic/Manual Selection Switch



(1) Manual doffing , (2) Manual doffing

Automatic doffing is not allowed. If this switch is placed at this position, no full-bobbin signal will be generated. (The FRD start signal is fixed to OFF.) The FL will ignore signals sent from the FRD.

You may move the bobbin rail manually by using the switches under restrictions on bobbin rail movement depending upon the FRD position. After bobbins become full, the bobbin rail will stop at the full-bobbin unloading position.

(3) Semi-automatic doffing

If this switch is placed at this position, semi-automatic doffing will take place. After the FRD loads empty-bobbins, the FL will be on standby.

When the FL is on standby, you need to move the bobbin rail manually to the winding start position and then press the FL start switch for starting automatic winding.

NOTE: In this automatic mode, do not use inching.

(4) Fully-automatic doffing

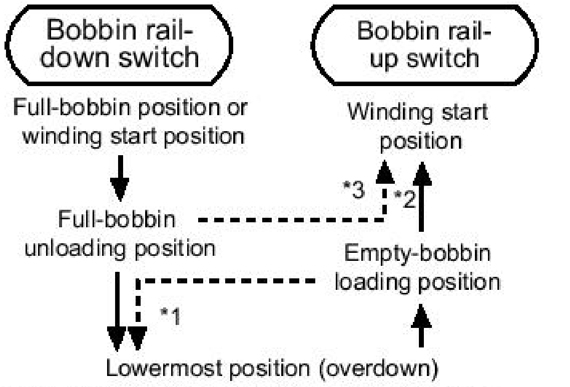
If this switch is placed at this position, fully-automatic doffing will take place. After the FRD loads empty-bobbins, the FL will carry out inclination detection, move up the bobbin rail to the winding start position, and then automatically start spinning.

[2] Bobbin Rail-down and Rail-up Switches

(1) If the Doffer selection switch is set to the "USE" position on the touch panel:
The bobbin rail-down switch and bobbin rail-up switch will work as shown at left.

(2) If the Doffer selection switch is set to the "UNUSE" position on the touch panel:
The bobbin rail-down switch and bobbin rail-up switch will work the same way as those of the FL not supporting the doffer.

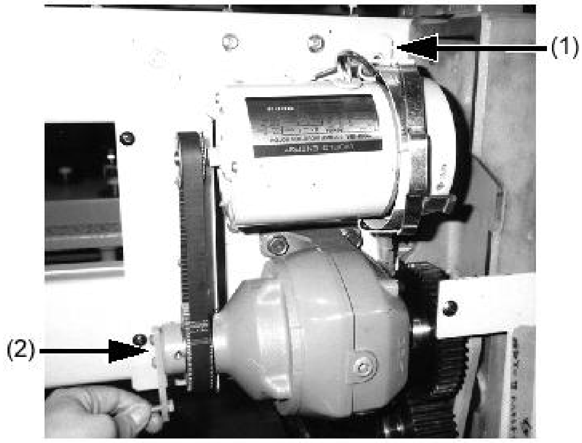
These switches are enabled only when the FL200 is on halt and the doffing automatic/ manual selection switch is set to the manual position.


Bobbin rail-down switch
Bobbin rail-up switch
Full-bobbin position or winding start position
Winding start position
*3
*2
Full-bobbin unloading position
Empty-bobbin loading position
*1
Lowermost position (overdown)

*1 When the bobbin rail is at the empty-bobbin loading position, pressing the bobbin rail-down switch will move the bobbin rail to the lowermost position.
*2 When the bobbin rail is at the empty-bobbin loading position, pressing the bobbin rail-up switch will carry out inclination detection and then move the bobbin rail to the winding start position.
*3 When the bobbin rail is at the full-bobbin unloading position, pressing the bobbin rail-up switch will move the bobbin rail to the winding start position.

4.3 Moving the Carrier and Lifter with the Handle

4.3.1 Moving the Carrier with the Handle



(1) Turn the brake lever (1) to the left to release the motor brake.

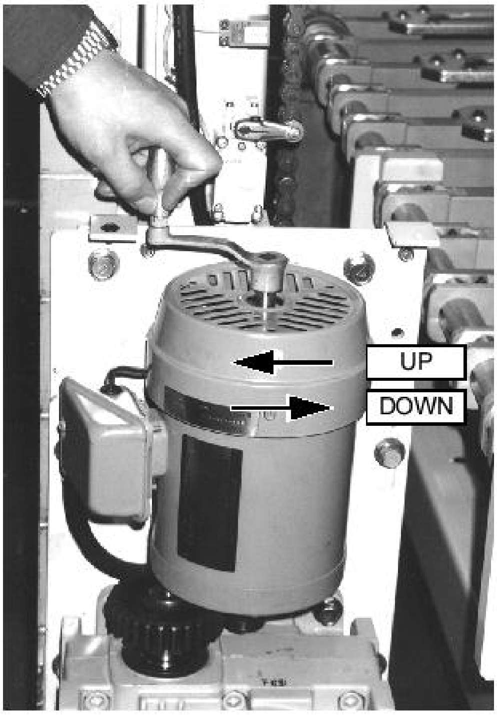
(2) Set the handle (2) to the timing pulley of the speed reduction gear.

NOTES:

- Be sure to turn the power off or press the emergency stop button before using the handle.
- After using the handle:

1) Turn the brake lever back to the right position.
2) Before driving the carrier with the motor, set the carrier origin.

4.3.2 Moving the Lifter with the Handle



Set the handle to the motor shaft. Turning the handle will move the lifter up or down.

NOTES:

- Before using the handle, be sure to check that the “DOFFING OK” signal (Sequencer, Unit 1, Port 2) to be sent from the transfer system is ON.
- Be sure to turn the power off before using the handle.
- Before moving the lifter with the handle, always unload full-bobbins from the hanger. Unloading empty-bobbins is not necessary.
- After moving the lifter with the handle, be sure to set the lifter origin.

5. INSTRUMENTATION

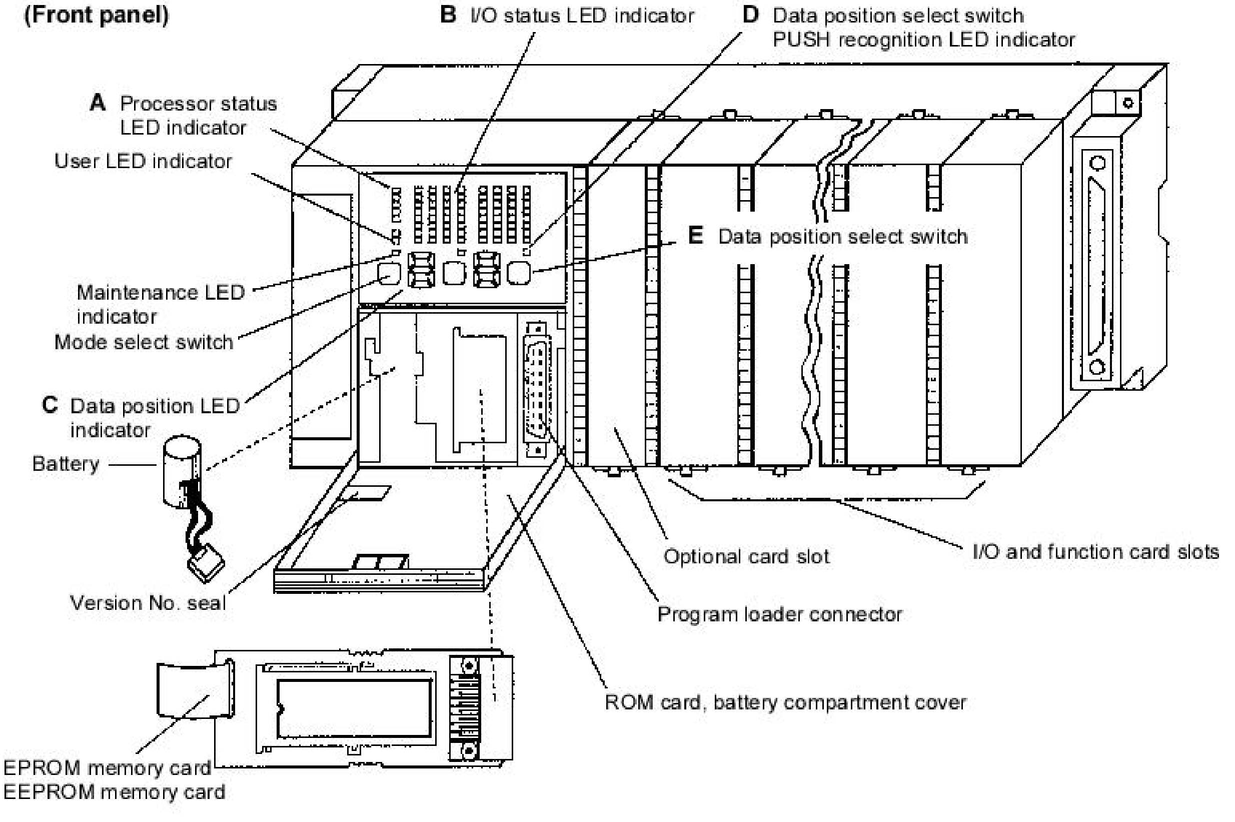
- See the appendix at the end of this publication for the layout diagram and the drawing of electrical equipment.

5.1 Main Equipment

5.1.1 Sequencer

[1] Basic Unit (Products of the Case Versions 1001 and Later)

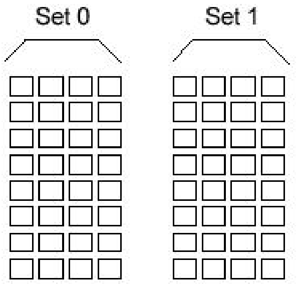
(1) Name and Function of Each Part


(Front panel)
B I/O status LED indicator
D Data position select switch
PUSH recognition LED indicator
A Processor status LED indicator
User LED indicator
E Data position select switch
Maintenance LED indicator
Mode select switch
C Data position LED indicator
Battery
Optional card slot
I/O and function card slots
Version No. seal
Program loader connector
ROM card, battery compartment cover
EPROM memory card
EEPROM memory card

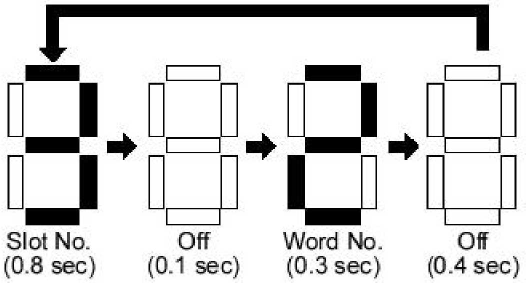
A Processor status LED indicator (basic unit only)
Indicates status of the processor with the following conditions:

LED	Color	Name	Indicating conditions	Built-in contact status during LED indicating
				RUN
POW	Green	Power supply normal operation	Processor power supply circuit output is normal.	ON/OFF (according to RUN indication)
RUN	Green	In operation	User program being executed	ON
ALM1	Red	Fatal fault	Fatal fault occurred (special relay F0010 to F001F is ON)	OFF
ALM2	Orange	Nonfatal fault	Nonfatal fault occurred (special relay F0020 to F002F is ON)	ON
BAT	Orange	Battery error	Battery is not installed or battery voltage is too low (special relay F0020 is ON)	ON
I/O	Green	I/O status indication	I/O status being indicated*	ON

* When I/O status LED indicator is ON, the user and maintenance status LED indicators go out.



Indicates ON/OFF status of I/O cards in units of 32 points.
Only 16 I/O points in the slot are indicated.
Lower 16 bits are OFF.



EXAMPLE:
Displaying words 2 and 3 in slot No. 3
(When 3 or more words are occupied, the above display is made.)

B I/O status LED indicator
Indicates I/O statuses on a unit basis.

NOTE: For sets 0 and 1, indication is made in the same manner (each operating independently).
By default, set 0 indicates slot 0 status.

C Data position LED indicator
Indicates the currently displayed data position (slot position and data position in the slot) with two LED's.
When the number of data items in the slot is 32 points (2 words) or less, only the slot position is indicated (for slots No. 0 to 7).

D Data position select switch PUSH recognition LED indicator
Lights or goes out each time the data position select switch is pressed. (There are two LED indicators corresponding to the two data position select switches.)

E Data position select switch
By pressing this switch, the slot position and data position in the slot can be changed. (Two data position select switches are provided.)

(2) Recognition of I/O data in each slot

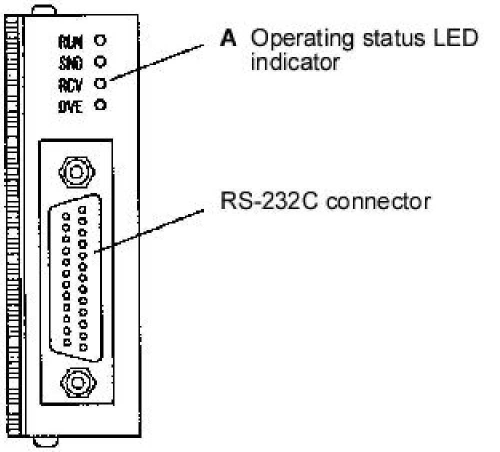
- By pressing the data position select switch on the display side 0, I/O data in each slot can be recognized.

Name undefined	**E** Data position select switch	**C** Data position LED indicator (7-segment LED)				**B** I/O status LED indicator	**D** Data position select switch PUSH recognition LED indicator
		Slot No. (0.8 sec)	OFF (0.1 sec)	In-slot word address (0.3 sec)	OFF (0.4 sec)		
ON		0	—	— No flicker	—	Upper 16 bits: Slot No. 0 Lower 16 bits: All points are turned off	OFF
		1	—	— No flicker	—	Upper 16 bits: Slot No. 1 Lower 16 bits: All points are turned off	ON
		2	—	— No flicker	—	Upper 16 bits: Slot No. 2 Lower 16 bits: All points are turned off	OFF
		3	—	— No flicker	—	Upper 16 bits: Slot No. 3 Lower 16 bits: All points are turned off	ON
		4	—	— No flicker	—	Upper 16 bits: Slot No. 4 Lower 16 bits: All points are turned off	OFF
		5	—	— No flicker	—	Upper 16 bits: Slot No. 5 Lower 16 bits: All points are turned off	ON
		6	—	— No flicker	—	Upper 16 bits: Slot No. 6, word 0 data Lower 16 bits: Slot No. 6, word 1 data	OFF
		7	OFF	0	OFF	Upper 16 bits: Slot No. 7, word 0 data Lower 16 bits: Slot No. 7, word 1 data	ON
		7	OFF	2	OFF	Upper 16 bits: Slot No. 7, word 2 data Lower 16 bits: Slot No. 7, word 3 data	OFF
		7	OFF	4	OFF	Upper 16 bits: Slot No. 7, word 4 data Lower 16 bits: Slot No. 7, word 5 data	ON
		7	OFF	6	OFF	Upper 16 bits: Slot No. 7, word 6 data Lower 16 bits: Slot No. 7, word 7 data	OFF
		7	OFF	8	OFF	Upper 16 bits: Slot No. 7, word 8 data Lower 16 bits: Slot No. 7, word 9 data	ON
		7	OFF	A	OFF	Upper 16 bits: Slot No. 7, word 10 data Lower 16 bits: Slot No. 7, word 11 data	OFF
		7	OFF	C	OFF	Upper 16 bits: Slot No. 7, word 12 data Lower 16 bits: Slot No. 7, word 13 data	ON
		7	OFF	E	OFF	Upper 16 bits: Slot No. 7, word 14 data Lower 16 bits: Slot No. 7, word 15 data	OFF
		0	—	— No flicker	—	Upper 16 bits: Slot No. 0, word 0 data Lower 16 bits: All points are turned off	ON
		1	—	— No flicker	—	Upper 16 bits: Slot No. 1, word 0 data Lower 16 bits: All points are turned off	OFF

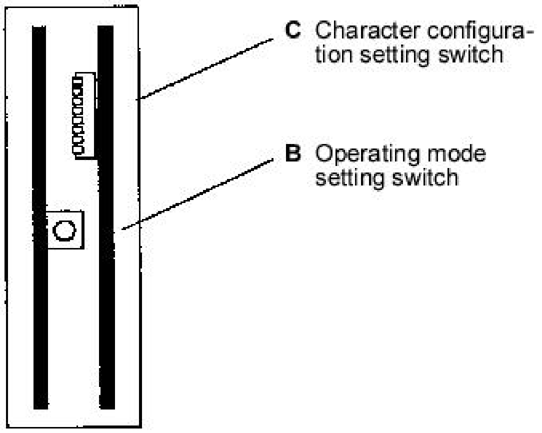
NOTE: With data status of display side 1, starts from slot No. 1

[2] Communication Unit

(Front panel)


RUN
SND
RCV
DVE
A Operating status LED indicator
RS-232C connector

(Rear panel)


C Character configura-tion setting switch
B Operating mode setting switch

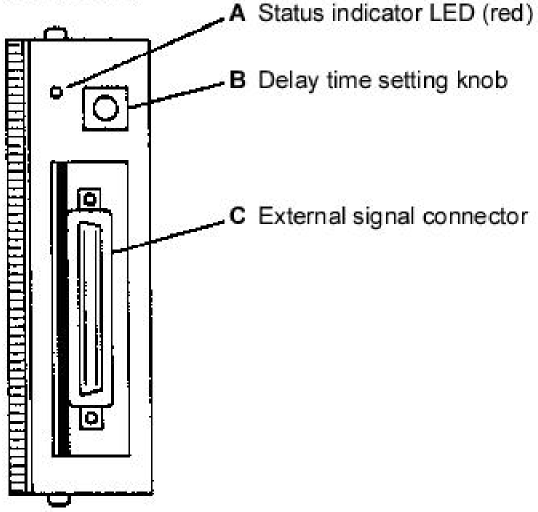
A Status indicator LEDs
Indicate operating status of the NV1L-RS2.

Symbol	Color	Meaning	Descriptions
RUN	Green	Normal operation	Lights when data transmission is enabled.
SND	Green	Transmitting	Lights when the RS2 is transmitting data to external equipment.
RCV	Green	Receiving	Lights when the RS2 is receiving data from external equipment.
DVE	Red	Module failure	Lights if a hardware failure occurs (such as RAM failure of the RS2).

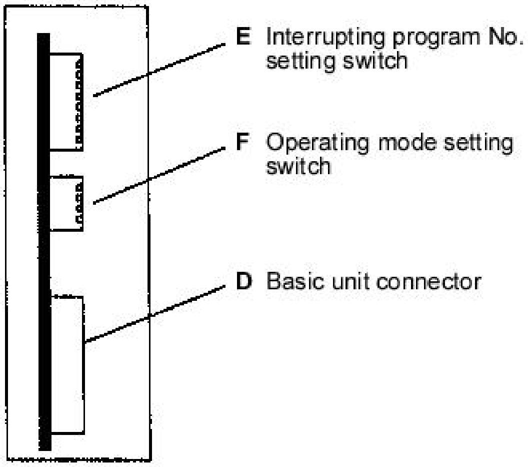
B For the setting of operating mode setting switch and **C** character configuration setting switch, see 5.2.1 Setting Sequencer.

[3] High-speed Counter Unit

(Front side)

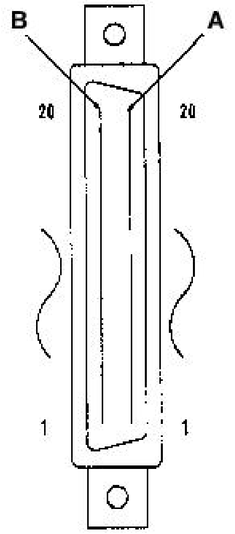

A Status indicator LED (red)
B Delay time setting knob
C External signal connector

(Rear side)


E Interrupting program No. setting switch
F Operating mode setting switch
D Basic unit connector

For setting, see 5.2.1 Setting Sequencer.

Pin layout as viewed from the power supply connector side



A Status indicator LED (red)............[Unused]
Indicates coincidence output (result of reference). Lights when referred results coincide.

B Delay time setting knob................[Unused]
Adjusts delay (approx. 10 ms to 100 ms) of coincidence output.
Set the output delay by giving consideration to the operating time of the load connected to the "coincidence output=" and the mechanical control system.

C External signal connector
Connector for I/O signals. Pin layout of external signals are as follows:

	B	A	
20	Phase A (+24 V input)	Phase A (+24 V input)	Input pulse
19	Phase A (+12 V input)	Phase A (+12 V input)	
18	Phase A (+5 V input)	Phase A (+5 V input)	
17	Phase A (0 V input)	Phase A (0 V input)	
16			
15	Phase B (+24 V input)	Phase B (+24 V input)	
14	Phase B (+12 V input)	Phase B (+12 V input)	
13	Phase B (+5 V input)	Phase B (+5 V input)	
12	Phase B (0 V input)	Phase B (0 V input)	
11			
10	Phase C (+24 V input)	Phase C (+24 V input)	
9	Phase C (+12 V input)	Phase C (+12 V input)	
8	Phase C (+5 V input)	Phase C (+5 V input)	
7	Phase C (0 V input)	Phase C (0 V input)	
6			
5	Current value > Reference value	Current value > Reference value	Reference external output
4	Current value = Reference value	Current value = Reference value	
3	Current value < Reference value	Current value < Reference value	
2	DC12/24V	DC12/24V	
1	DC0V	DC0V	

See 5.2.1 Setting Sequencer each of switches **E** and **F**.

[4] Eeprom Memory Card

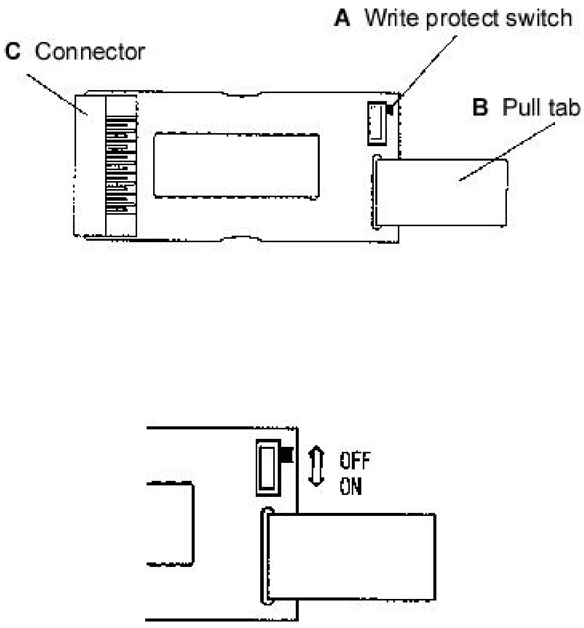
Card for program storage. When turned ON after being connected to the main unit, the program is loaded to the main unit.

(1) Name and function of EEPROM memory card (type: NV1VME-10)

A Write protect switch
Enables and disables write operation to the EEPROM.
To avoid malfunction of the processor, be sure to turn off the power of the basic unit before setting this switch.

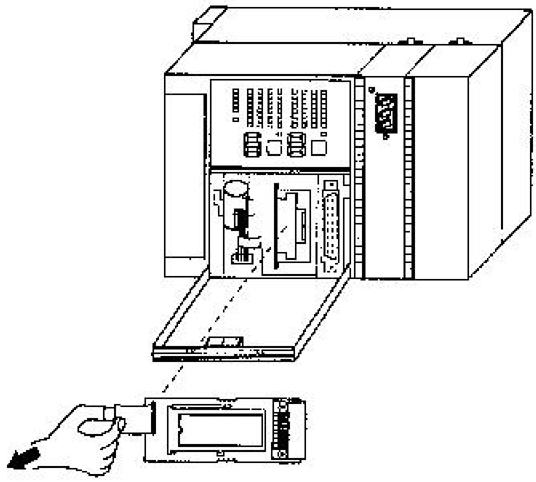
B Pull tab
When pulling out the EEPROM memory card from the basic unit, grasp this tab firmly, then pull it slowly.

C Connector
Used to connect the EEPROM memory card to the basic unit.



OFF: Write protection is off. Enables program write operation.
ON: Write protection is on. Disables program write operation.

(2) Handling of EEPROM memory card



ORIENTATION OF THE CARD: Insert the card so that the parts mount surface is to the front right-hand side.

■ **Installing the card**

1) Turn off the power of the basic unit. Then confirm the orientation of the card, and insert it into the slot of the basic unit.
2) Push the card with your fingers until it fits into position.

■ **Removing the card**

1) Turn off the power of the basic unit, grasp the pull tab, and then pull out the card slowly.

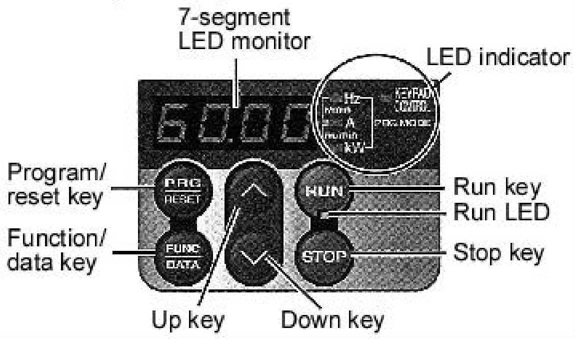
NOTES:

- Before installing or removing the memory card, turn off the power of the basic unit. Inserting or removing the memory card without turning off the power may cause damages to it or basic unit and/or cause malfunction of the basic unit.
- Before setting the memory setting switch (the write protect switch of the NV1VME-10), turn off the power of the basic unit. Setting the switch without turning off the power may cause malfunction of the basic unit.

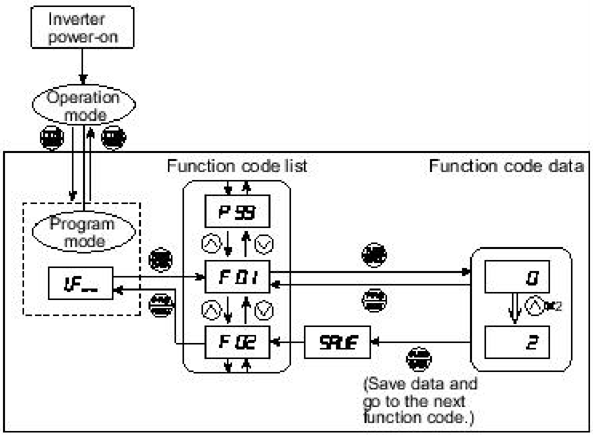
5.1.2 Inverter

How to change the set value of the inverter

Inverter operation panel


7-segment LED monitor
LED indicator
Program/ reset key
Function/ data key
Run key
Run LED
Stop key
Up key
Down key
60.00
Hz
A
kW
KEYPAD CONTROL
PRG.MODE
PRG RESET
FUNC DATA
RUN
STOP

Setting of data change during a stop


Inverter power-on
Operation mode
Program mode
Function code list
Function code data
P 99
F 01
F 02
1.F__
0
2
SAVE
×2
(Save data and go to the next function code.)

■ **Basic key operation**

The basic key operation is described according to the function code data change procedure shown in the figure on the left.

In this example, the data of frequency setting method selection function code F01 is changed from “keypad operation (F01=0)” back to factory shipment setting “current input (terminal C1) (DC +4 to +20 mA) (F01=2).”

(1) After the power is turned on, the operation mode automatically starts. In the operation mode, press the PRG RESET key to enter the program mode. The function selection menu is displayed.

(2) Press ∧/∨ keys until “1.F__” is displayed, and press the FUNC DATA key to select.

(3) Press ∧/∨ keys to select the target function code, and press the FUNC DATA key. (In this example, function code F01 is selected.)
The data of the corresponding function code is displayed. (Data 0 of F01 is displayed.)

(4) Use the ∧/∨ keys to change the function code data. (In this example, press the ∧ key twice to change function code data “0” to “2.”)

(5) Press the FUNC DATA key to determine the function code data.
“SAVE” is displayed and the data is saved in the memory inside the inverter. Indication returns to the function code list and the next function code. (In this example, “F02” is displayed.)
Press the PRG RESET key before pressing the FUNC DATA key to cancel data change and show the original function code.

(6) To return from the function code list to the menu, press the PRG RESET key.

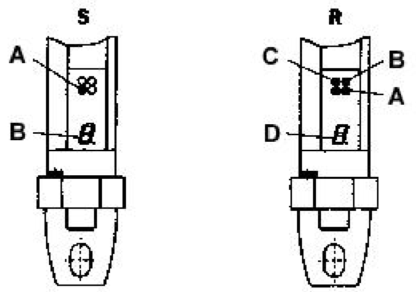
REFERENCE: <Cursor move>

Press and hold the PRG RESET key for one second or longer during function code data change, too, to move the blinking place so that data change can be made at the digit. This operation is called cursor move.

5.1.3 Area Sensor and Controller

(1) Area sensor

Indicator lamp:



Projector = S

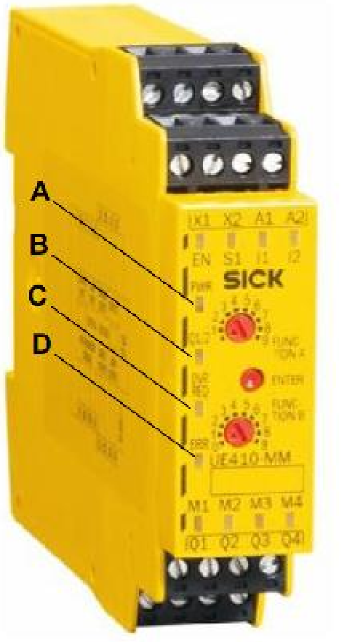
Number	Indicator lamp	Meaning/Function
A	LED, yellow	Supplied power ON
B	7-segment display	Indicates malfunction and startup code. See 6.6.3 Area Sensor Error

Optical receiver = R

Number	Indicator lamp	Meaning/Function
A	LED, green	Optical axis is not shielded.
B	LED, red	Optical axis is shielded.
C	LED, amber	Contamination signal
D	7-segment display	Indicates malfunction and startup code. See 6.6.3 Area Sensor Error

NOTE: The function is for C2000 extension version only.

(2) Controller



Number	Indicator lamp	Meaning
A	PWR	Power is “ON.”
B	Q1/2	Output is active.
C	OVR REQ	Waiting for input of reset.
D	ERR	Having an error.

Error conditions are also indicated by the combinations of turning on and blinking of the indicator lamps (see 6.6.2).

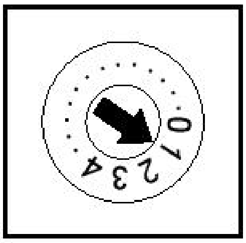
5.2 Setting of Electrical Equipment in the Control Box

5.2.1 Setting Sequencer

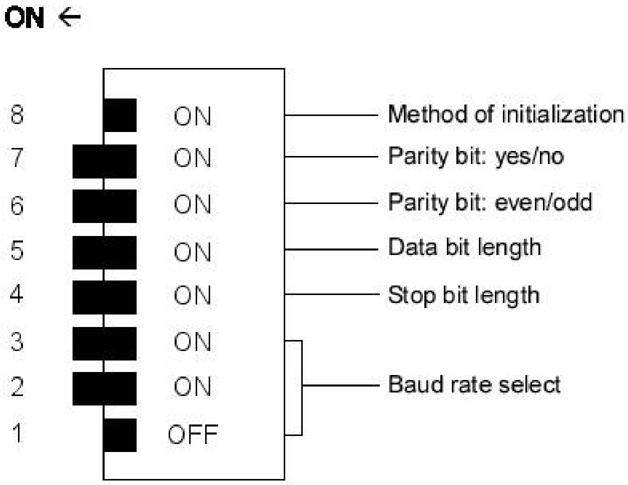
(1) Communication unit (NV1L-RS2Z4)

Operating mode setting switch:

Set to No. 1.

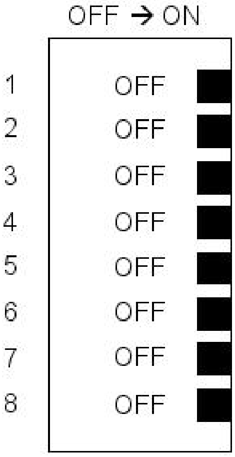


Character configuration switch

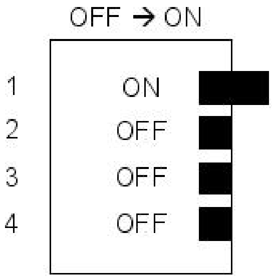

ON ←
8 ON Method of initialization
7 ON Parity bit: yes/no
6 ON Parity bit: even/odd
5 ON Data bit length
4 ON Stop bit length
3 ON
2 ON Baud rate select
1 OFF

(2) High-speed counter (NV1F-HC1Z4)

Interrupt program No. setting switch


OFF → ON
1 OFF
2 OFF
3 OFF
4 OFF
5 OFF
6 OFF
7 OFF
8 OFF

Operating mode setting switch


OFF → ON
1 ON
2 OFF
3 OFF
4 OFF

Delay time setting knob

Not used, hence no setting

5.2.2 Setting Inverter

■ F code: Fundamental Functions

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
F00	Data protection	0: Disable data protection, disable digital setting protection 1: Enable data protection, disable digital setting protection 2: Disable data protection, enable digital setting protection 3: Enable data protection, enable digital setting protection	—	—	O	0	0	0
F01	Frequency setting 1	0: Keypad key operation (∧/∨ keys) 1: Analog voltage input (terminal 12) (DC0 to ±10 V) 2: Analog current input (terminal C1 (C1 function)) (DC4 to 20 mA) 3: Analog voltage input (terminal 12) + analog current input (terminal C1 (C1 function)) 5: Analog voltage input (terminal C1 (V2 function)) (DC0 to +10 V) 7: UP/DOWN control 11: Digital input (option) 12: Pulse string input (option)	—	—	×	0	0	0
F02	Running/stopping	0: Keypad operation (direction of rotation input, terminal block) 1: Ext. signal (digital input) 2: Keypad operation (forward) 3: Keypad operation (reverse)	—	—	×	2	1	1
F03	Max. output frequency 1	25.0 to 400.0 Hz	0.1	Hz	×	60.0	60.0	50.0
F04	Base frequency 1	25.0 to 400.0 Hz	0.1	Hz	×	50.0	60.0	50.0
F05	Rated voltage at base frequency 1	0 V: Voltage output in proportion to source voltage 80 to 240 V: AVR operation	1	V	×	200	200	200
F06	Max. output voltage 1	80 to 240 V: AVR operation	1	V	×	200	200	200
F07	Acceleration time 1	0.00 to 3600 s * "0.00": acceleration time cancel (in case of external software start/stop)	0.01	s	O	6.00	2.00	2.00
F08	Deceleration time 1	0.00 to 3600 s * "0.00": deceleration time cancel (in case of external software start/stop)	0.01	s	O	6.00	0.50	0.50
F09	Torque boost 1	0.0 to 20.0% (F05: % to base frequency voltage 1)	0.1	%	O	0.2 kW : 8.4 1.5 kW : 6.8	8.4	6.8
F10	Electronic thermal overload relay 1 for motor protection (Motor property selection)	1: For general-purpose motors with self-cooling fan 2: For motors with forced-cooled fan	—	—	O	1	1	1
F11	(Level)	0.00 (Disabled) 1 to 135% of rated inverter output current	0.01	A	O	0.2 kW : 1.30 1.5 kW : 6.10	0.57	4.70
F12	(Thermal time constant)	0.5 to 75.0 min	0.1	min	O	5.0	5.0	5.0
F14	Restart mode after momentary power failure (Mode selection)	0: Disabled (Immediately trip without restart) 1: Disabled (Trip without restart after recovery of power) 4: Enabled (Restart at the frequency at which the power failure occurred; for general loads) 5: Enabled (Restart at the starting frequency; for low-inertia loads)	—	—	O	1	1	1
F15	Frequency limiter (Peak)	0.0 to 400.0 Hz	0.1	Hz	O	70.0	70.0	70.0
F16	(Bottom)	0.0 to 400.0 Hz	0.1	Hz	O	0.0	0.0	0.0
F18	Bias (frequency setting 1)	–100.00 to 100.00%	0.01	%	⊙	0.00	0.00	0.00
F20	DC braking 1 (Starting frequency)	0.0 to 60.0 Hz	0.1	Hz	O	0.0	8.0	8.0
F21	(Level)	0 to 100% (To rated output current of inverter)	1	%	O	0	20	60
F22	(Time)	0.00 s (Disabled), 0.01 to 30.00 s	0.01	s	O	0.00	1.00	1.00
F23	Starting frequency 1	0.1 to 60.0 Hz	0.1	Hz	O	0.5	1.0	1.0
F24	(Continuation time)	0.00 to 10.00 s	0.01	s	O	0.00	0.00	0.00
F25	Stopping frequency	0.1 to 60.0 Hz	0.1	Hz	O	0.2	0.2	0.2

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
F26	Motor sound (Carrier frequency)	0.75 to 15 kHz	1	kHz	○	2	2	2
F27	(Sound tone)	0: Level 0 (Disabled) 1: Level 1 2: Level 2 3: Level 3	—	—	○	0	0	0
F29	Terminal FM (Mode selection)	0: Voltage output (DC0 to 10 V) (FMA function) 2: Pulse output (FMP function)	—	—	○	0	0	0
F30	(Gain to output voltage)	0 to 300% (FMA function)	1	%	⊙	100	100	100
F31	(Function selection)	Select one of the following items and enter the corresponding code. 0: Output frequency 1 (before slip compensation) 1: Output frequency 2 (after slip compensation) 2: Output current 3: Output voltage 4: Output torque 5: Load ratio 6: Power consumption 7: PID feedback amount (PV) 8: PG feedback amount 9: DC link circuit voltage 10: Universal AO 13: Motor output 14: Analog output test 15: PID command (SV) 16: PID output (MV)	—	—	○	0	5	5
F33	(Pulse rate)	25 to 6000 p/s (Number of pulses at 100%) (FMP function)	1	p/s	⊙	1440	1440	1440
F37	Load selection/ auto torque boost/ auto energy saving operation 1	0: Variable torque load 1: Constant torque load 2: Auto torque boost 3: Auto energy saving operation (variable torque load) 4: Auto energy saving operation (constant torque load) 5: Auto energy saving operation (auto torque boost)	—	—	×	1	2	2
F39	Stopping frequency (Continuation time)	0.00 to 10.00 s	0.01	s	○	0.00	0.00	0.00
F40	Torque limit 1 (Driving)	20 to 200%, 999: Disabled	1	%	○	999	999	999
F41	(Braking)	20 to 200%, 999: Disabled	1	%	○	999	999	999
F42	Control method selection 1	0: Disabled (V/f control; without slip compensation) 1: Enabled (dynamic torque vector control) 2: Enabled (V/f control; with slip compensation) 3: Enabled (V/f control with PG) 4: Enabled (dynamic torque vector control with PG)	—	—	×	0	1	1
F43	Current limiter (Mode selection)	0: Disabled 1: In constant speed operation (disabled during acceleration and deceleration) 2: In acceleration and constant speed operation (disabled during deceleration)	—	—	○	2	2	2
F44	(Level)	20 to 200% (To rated output current of inverter)	1	%	○	180	180	180
F50	Electronic thermal overload relay (Discharging capability) (For braking resistor protection)	0 to 900 kWs, 999 (Cancel)	1	kWs	○	999	999	999
F51	(Allowable average loss)	0.000 (In case of models with built-in braking resistor), 0.001 to 50.000 kW	0.001	kW	○	0.000	0.000	0.000

■ E code: Extension Terminal Functions

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
E01	Terminal X1 (Function selection)	Select among the following items and enter the code. 0 (1000): Multistep frequency selection (0 or 1 step) "SS1" 1 (1001): Multistep frequency selection (0 to 3 steps)"SS2" 2 (1002): Multistep frequency selection (0 to 7 steps)"SS4" 3 (1003): Multistep frequency selection (0 to 15 steps) "SS8" 4 (1004): Acceleration/deceleration selection (2 steps)"RT1" 6 (1006): Self-hold selection "HLD" 7 (1007): Coast-to-stop command "BX" 8 (1008): Alarm reset "RST" 9 (1009): External alarm "THR" 10 (1010): Jogging operation "JOG" 11 (1011): Frequency setting 2/1 "Hz2/Hz1" 12 (1012): Motor 2/1 "M2/M1" 13 : DC brake command "DCBRK" 14 (1014): Torque limit 2/1 "TL2/TL1" 17 (1017): UP command "UP" 18 (1018): DOWN command "DOWN" 19 (1019): Enable editing (data change enabled) "WE-KP" 20 (1020): PID control cancel "Hz/PID" 21 (1021): Switch normal/inverse driving "IVS" 24 (1024): Link operation selection (RS-485 standard, BUS Option) "LE" 25 (1025): Universal DI "U-DI" 26 (1026): Starting characteristic selection "STM" 27 (1027): Speed feedback control switch "PG/Hz" 30 (1030): Forced stop "STOP" 33 (1033): Reset PID integral and differential components "PID-RST" 34 (1034): Hold PID integral component "PID-HLD" 42 (1042): Zero position limit switch "LS" 43 (1043): Start/reset "S/R" 44 (1044): Serial pulse reception mode "SPRM" 45 (1045): Return mode "RTN" 46 (1046): Validate overload stop command "OLS" * Enter the code in 1000 s specified in parentheses () for a logical inverse signal. (Active-off)However, with "THR," specify "9" ("1009") for active off (on). With "STOP," specify "30" ("1030") for active off (on). Signals having no code specified in parentheses () are incapable of logical inversion.	—	—	×	0	0	0
E02	Terminal X2		—	—	×	1	1	1
E03	Terminal X3		—	—	×	2	2	2
E04	Terminal X4		—	—	×	7	7	7
E05	Terminal X5		—	—	×	8	8	8
E10	Acceleration time 2	0.00 to 3600 s * Specify "0.00" to cancel the acceleration time. (Cases with external software start/stop)	0.01	s	○	10.0	10.0	10.0
E11	Deceleration time 2	0.00 to 3600 s * Specify "0.00" to cancel the deceleration time. (Cases with external software start/stop)	0.01	s	○	10.0	10.0	10.0
E16	Torque limit 2 (Driving)	20 to 200%, 999: Disabled	1	%	○	999	999	999
E17	(Braking)	20 to 200%, 999: Disabled	1	%	○	999	999	999

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
E20	Terminal Y1 (Function selection)	Select among the following items and enter the code. 0 (1000): Running "RUN" 1 (1001): Frequency arrival "FAR" 2 (1002): Frequency detection "FDT" 3 (1003): Stopped due to undervoltage "LU" 4 (1004): Torque polarity detection "B/D" 5 (1005): Inverter output limiting "IOL" 6 (1006): Restarting after momentary power failure "IPF" 7 (1007): Motor overload early warning "OL" 10 (1010): Operation preparation output "RDY" 21 (1021): Frequency arrival 2 "FAR2" 22 (1022): Inverter output limiting (with delay) "IOL2" 26 (1026): Retrying "TRY" 27 (1027): Universal DO "U-DO" 28 (1028): Heat sink overheat early warning "OH" 30 (1030): Lifetime alarm "LIFE" 33 (1033): Command loss detection "REF OFF" 35 (1035): Inverter outputting "RUN2" 36 (1036): Overload prevention control "OLP" 37 (1037): Current detection "ID" 38 (1038): Current detection 2 "ID2" 42 (1042): PID alarm output "PID-ALM" 49 (1049): Motor 2 switch "SWM2" 56 (1056): Thermistor detection (PTC) "THM" 57 (1057): Brake signal "BRKS" 59 (1059): C1 terminal broken wire detection "C1OFF" 76 (1076): PG alarm signal "PG-ERR" 80 (1080): Stop point error alarm "OT" 81 (1081): Timer output "TO" 82 (1082): Positioning completion signal "PSET" 83 (1083): Current position pulse overflow "POF" 99 (1099): Alarm relay output "ALM" * Enter the code in 1000 s specified in parentheses () for a logical inverse signal. (Active off)	—	—	×	0	0	0
E21	Terminal Y2		—	—	×	7	7	7
E27	Terminal 30A/B/C (Relay output)		—	—	×	99	99	99
E29	Frequency arrival delay (FAR2)	0.01 to 10.0 s	0.01	s	○	0.10	0.10	0.10
E30	Frequency arrival (FAR, FAR2) (Detection width)	0.0 to 10.0 Hz	0.1	Hz	○	2.5	2.5	2.5
E31	Frequency detection (FDT) (Level)	0.0 to 400.0 Hz	0.1	Hz	○	60.0	60.0	60.0
E32	(Hysteresis width)	0.0 to 400.0 Hz	0.1	Hz	○	1.0	1.0	1.0
E34	Overload early warning/ current detection (Level)	0 (Disabled). 1 to 200% of rated inverter output current	0.01	A	○	0.2 kW : 1.30 1.5 kW : 6.10	1.30	6.10
E35	(Timer time)	0.01 to 600.00 s	0.01	s	○	10.00	10.00	10.00
E37	Current detection 2 (Level)	0 (Disabled). 1 to 200% of rated inverter output current	0.01	A	○	0.2 kW : 1.30 1.5 kW : 6.10	1.30	6.10
E38	(Timer time)	0.01 to 600.00 s	0.01	s	○	10.00	10.00	10.00
E39	Coefficient for constant feeding rate time	0.000 to 9.999	0.001	—	○	0.000	0.000	0.000
E40	PID display coefficient A	–999 to 0.00 to 9990	0.01	—	○	100	100	100
E41	PID display coefficient B	–999 to 0.00 to 9990	0.01	—	○	0.00	0.00	0.00
E42	Display filter	0.0 to 5.0 s	0.1	s	○	0.5	0.5	0.5
E43	LED monitor (Display selection)	0: Speed monitor (Select with E48.) 3: Output current 4: Output voltage 8: Calculated torque 9: Power consumption 10: PID command (final) 12: PID feedback value 13: Timer value (for timer operation) 14: PID output 15: Load ratio 16: Motor output 21: Current position pulse 22: Position deviation pulse	—	—	○	0	0	0

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
E45	LCD monitor (Display selection)	0: Operation guidance screen display 1: Bar graph (speed, current, torque)	—	—	○	0	0	0
E46	(Language selection)	0: Japanese 1: English 2: German 3: French 4: Spanish 5: Italian	—	—	○	0	1	1
E47	(Contrast adjustment)	0 (pale) to 10 (crisp)	1	—	○	5	5	5
E48	LED monitor details (Speed monitor selection)	0: Output frequency (before slip compensation) 1: Output frequency (after slip compensation) 2: Frequency setting 3: Motor speed 4: Load speed 5: Line speed 6: Constant feeding rate time	—	—	○	0	0	0
E50	Speed indication coefficient	0.01 to 200.00	0.01	—	○	30.00	30.00	30.00
E51	Cumulative wattage data indication coefficient	0.000 (Cancel and reset), 0.001 to 9999	0.001	—	○	0.010	0.010	0.010
E52	Keypad menu selection	0: Function code data setting mode (menu number 0, 1) 1: Function code data check mode (menu number 2) 2: Full menu mode	—	—	○	0	0	0
E59	Terminal C1 function selection (C1/V2 function)	0: Analog current input (C1 function) (DC4 to 20 mA) 1: Analog voltage input (V2 function) (DC0 to +10 V)	—	—	×	0	0	0
E61	Terminal 12 (Extended function selection)	Select among the following items and enter the code. 0: No assignment of extended function 1: Auxiliary frequency setting 1 2: Auxiliary frequency setting 2 3: PID process command 1 5: PID feedback value	—	—	×	0	0	0
E62	Terminal C1 (C1 function)		—	—	×	0	0	0
E63	Terminal C1 (V2 function)		—	—	×	0	0	0
E65	Command loss detection (Operation continuation frequency)	0 (Controlled stop), 20 to 120%, 999 (Switching disabled)	1	%	○	999	999	999

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
E98	Terminal FWD (Function selection)	Select among the following items and enter the code. 0 (1000): Multistep frequency selection (0 or 1 step) "SS1" 1 (1001): Multistep frequency selection (0 to 3 steps) "SS2" 2 (1002): Multistep frequency selection (0 to 7 steps) "SS4" 3 (1003): Multistep frequency selection (0 to 15 steps) "SS8" 4 (1004): Acceleration/deceleration selection (2 steps) "RT1" 6 (1006): Self hold selection "HLD" 7 (1007): Coast-to-stop command "BX" 8 (1008): Alarm reset "RST" 9 (1009): External alarm "THR" 10 (1010): Jogging operation "JOG" 11 (1011): Frequency setting 2/1 "Hz2/Hz1" 12 (1012): Motor 2/1 "M2/M1" 13 : DC brake command "DCBRK" 14 (1014): Torque limit 2/1 "TL2/TL1" 17 (1017): UP command "UP" 18 (1018): DOWN command "DOWN" 19 (1019): Enable editing (data change allowed) "WE-KP" 20 (1020): PID control cancel "Hz/PID" 21 (1021): Switch normal/inverse driving "IVS" 24 (1024): Link operation selection (RS-485 standard, BUS Option) "LE" 25 (1025): Universal DI "U-DI" 26 (1026): Starting characteristic selection "STM" 27 (1027): Speed feedback control switch "PG/Hz" 30 (1030): Forced stop "STOP" 33 (1033): Reset PID integral and differential components "PID-RST" 34 (1034): Hold PID integral component "PID-HLD" 42 (1042): Zero position limit switch "LS" 43 (1043): Start/reset "S/R" 44 (1044): Serial pulse reception mode "SPRM" 45 (1045): Return mode "RTN" 46 (1046): Validate overload stop command "OLS" 98 : Forward operation/stop command "FWD" 99 : Reverse operation/stop command "REV" * Enter the code in 1000 s specified in parentheses () for a logical inverse signal. (Active-off)However, with "THR," specify "9" ("1009") for active off (on). With "STOP," specify "30" ("1030") for active off (on). Signals having no code specified in parentheses () are incapable of logical inversion.	—	—	×	98	98	98
E99	Terminal REV		—	—	×	99	99	99

■ C code: Control Functions of Frequency

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
C01	Jump frequency 1	0.00 to 400.0 Hz	0.1	Hz	O	0.0	0.0	0.0
C02	2				O	0.0	0.0	0.0
C03	3				O	0.0	0.0	0.0
C04	(Width)	0.0 to 30.0 Hz	0.1	Hz	O	3.0	3.0	3.0
C05	Multistep frequency 1	0.00 to 400.0 Hz	0.01	Hz	O	0.00	10.0	10.0
C06	2				O	0.00	30.0	30.0
C07	3				O	0.00	60.0	45.0
C08	4				O	0.00	0.00	0.00
C09	5				O	0.00	0.00	0.00
C10	6				O	0.00	0.00	0.00
C11	7				O	0.00	0.00	0.00
C12	8				O	0.00	0.00	0.00
C13	9				O	0.00	0.00	0.00
C14	10				O	0.00	0.00	0.00
C15	11				O	0.00	0.00	0.00
C16	12				O	0.00	0.00	0.00
C17	13				O	0.00	0.00	0.00
C18	14				O	0.00	0.00	0.00
C19	15				O	0.00	0.00	0.00
C20	Jogging frequency	0.00 to 400.0 Hz	0.01	Hz	O	0.00	0.00	0.00
C21	Timer operation (Mode selection)	0: Disabled 1: Enabled	—	—	×	0	0	0
C30	Frequency setting 2	0: Keypad key operation (⋀/⋁ key) 1: Analog voltage input (terminal 12) (DC0 to ±10 V) 2: Analog current input (terminal C1 (C1 function)) (DC4 to 20 mA) 3: Analog voltage input (terminal 12) + analog current input (terminal C1 (C1 function)) 5: Analog voltage input (terminal C1 (V2 function)) (DC0 to +10 V) 7: UP/DOWN control 11: Digital input (option) 12: Pulse string input (option)	—	—	×	2	2	2
C31	Analog input adjustment (Offset)	–5.0 to +5.0%	0.1	%	⊙	0.0	0.0	0.0
C32	(terminal 12) (Gain)	0.00 to 200.00%	0.01	%	⊙	100.0	100.0	100.0
C33	(Filter)	0.00 to 5.00 s	0.01	s	O	0.05	0.05	0.05
C34	(Gain reference point)	0.00 to 100.00%	0.01	%	⊙	100.0	100.0	100.0
C35	(Polarity selection)	0: Bipolar 1: Unipolar	—	—	×	1	1	1
C36	Analog input adjustment (Offset)	–5.0 to +5.0%	0.1	%	⊙	0.0	0.0	0.0
C37	(terminal C1 (C1 function)) (Gain)	0.00 to 200.00%	0.01	%	⊙	100.0	100.0	100.0
C38	(Filter)	0.00 to 5.00 s	0.01	s	O	0.05	0.05	0.05
C39	(Gain reference point)	0.00 to 100.00%	0.01	%	⊙	100.0	100.0	100.0
C41	Analog input adjustment (Offset)	–5.0 to +5.0%	0.1	%	⊙	0.0	0.0	0.0
C42	(Terminal C1 (V2 function)) (Gain)	0.00 to 200.00%	0.01	%	⊙	100.0	100.0	100.0
C43	(Filter)	0.00 to 5.00 s	0.01	s	O	0.05	0.05	0.05
C44	(Gain reference point)	0.00 to 100.00%	0.01	%	⊙	100.0	100.0	100.0
C50	Bias (frequency setting 1) (Bias reference point)	0.00 to 100.00%	0.01	%	⊙	0.00	0.00	0.00
C51	Bias (PID command 1) (Bias value)	–100.00 to 100.00%	0.01	%	⊙	0.00	0.00	0.00
C52	(Bias reference point)	0.00 to 100.00%	0.01	%	⊙	0.00	0.00	0.00
C53	Normal/inverse operation selection (Frequency setting 1)	0: Normal operation 1: Inverse operation	—	—	O	0	0	0

■ P code: Motor Parameters 1

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
P01	Motor 1 (No. of poles)	2 to 22 poles	2	Poles	×	4	4	4
P02	(Capacity)	0.01 to 30.00 kW (For motors with P99 setting being 0, 3 or 4) 0.01 to 30.00 HP (For motors with P99 setting being 1)	0.01 0.01	kW HP	×	0.2 kW : 0.2 1.5 kW : 1.50	0.1	0.75
P03	(Rated current)	0.00 to 100.0 A	0.01	A	×	0.2 kW : 1.30 1.5 kW : 6.10	0.57	3.80
P04	(Auto tuning)	0: Disabled 1: Enabled (%R1 and %X are tuned with the motor stopped) 2: Enabled (%R1, %X and rated slip are turned with the motor stopped, and the non-load current is tuned with the motor running.)	—	—	×	0	0	0
P05	(Online tuning)	0: Disabled 1: Enabled	—	—	○	0	0	0
P06	(No-load current)	0.00 to 50.00 A	0.01	A	×	0.2 kW : 1.06 1.5 kW : 3.01	0.41	2.55
P07	(%R1)	0.00 to 50.00%	0.01	%	○	0.2 kW : 12.95 1.5 kW : 6.55	14.25	7.19
P08	(%X)	0.00 to 50.00%	0.01	%	○	0.2 kW : 12.92 1.5 kW : 11.21	18.27	12.88
P09	(Slip compensation gain (driving))	0.0 to 200.0%	0.1	%	◎	100.0	100.0	100.0
P10	(Slip compensation response time)	0.01 to 10.00 s	0.01	s	○	0.50	0.50	0.50
P11	(Slip compensation gain (braking))	0.0 to 200.0%	0.1	%	◎	100.0	100.0	100.0
P12	(Rated slip)	0.00 to 15.00 Hz	0.01	Hz	×	0.2 kW : 2.33 1.5 kW : 2.00	1.77	2.33
P99	Motor 1 selection	0: Motor characteristic 0 (Fuji's 8 Series standard motor) 1: Motor characteristic 1 (HP motor) 3: Motor characteristic 3 (Fuji's 6 Series standard motor) 4: Others	—	—	×	0	0	0

■ H code: High Performance Functions

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
H03	Data initialization	0: Manual setting 1: Initial value (factory shipment setting) 2: Initialize motor constants 1 3: Initialize motor constants 2	—	—	×	0	0	0
H04	Retry (Frequency)	0: Disabled, 1 to 10 times	1	Times	○	0	0	0
H05	(Latency time)	0.5 to 20.0 s	0.1	s	○	5.0	5.0	5.0
H06	Cooling fan ON/OFF control	0: Disabled (Always ON) 1: Enabled (ON/OFF control valid)	—	—	○	0	0	0
H07	Gradient acceleration/ deceleration	0: Disabled (Linear acceleration/deceleration) 1: S-curve acceleration/deceleration (weak) 2: S-curve acceleration/deceleration (strong) 3: Curve acceleration/deceleration	—	—	○	0	0	0
H08	Limitation on direction of rotation	0: Disabled 1: Enabled (Reverse rotation locked) 2: Enabled (Forward rotation locked)	—	—	×	0	0	0
H09	Starting characteristics (Pick-up mode)	0: Disabled 1: Enabled (Restart after momentary power failure only) 2: Enabled (Regular start and restart after momentary power failure only)	—	—	×	0	0	0
H11	Deceleration mode	0: Regular deceleration 1: Coast to stop	—	—	○	0	0	0
H12	Limitation on instantaneous over-current (Mode selection)	0: Disabled 1: Enabled	—	—	○	1	1	1

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
H13	Restart after momentary power failure (Delay)	0.1 to 10.0 s	0.1	s	O	0.5	0.5	0.5
H14	(Frequency reduction ratio)	0.00: Selected deceleration time 0.01 to 100.00 Hz/s, 999 (As per current limit)	0.01	Hz/s	O	999	999	999
H16	(Time allowed for momentary power failure)	0.0 to 30.0 s, 999 (Automatic judgment by inverter)	0.1	s	O	999	999	999
H26	Thermistor (Mode selection)	0: Disabled 1: Enabled (PTC: OH4 trip and inverter stop) 2: Enabled (PTC: "THM" output signal and operation continued)	—	—	O	0	0	0
H27	(Level)	0.00 to 5.00 V	0.01	V	O	1.60	1.60	1.60
H28	Droop control	–60.0 to 0.0 Hz	0.1	Hz	O	0.0	0.0	0.0
H30	Link function (Mode selection)	Frequency command / Operation command 0: F01/C30 / F02 1: RS-485 communication / F02 2: F01/C30 / RS-485 communication 3: RS-485 communication / RS-485 communication 4: RS-485 communication (option) / F02 5: RS-485 communication (option) / RS-485 communication 6: F01/C30 / RS-485 communication (option) 7: RS-485 communication / RS-485 communication (option) 8: RS-485 communication (option) / RS-485 communication (option)	—	—	O	0	0	0
H42	Main-circuit capacitor measurement	For replacement timing adjustment (0000 to FFFF (hex.))	1	—	O	—	—	—
H43	Cumulative cooling fan run hours	For replacement timing adjustment; the cumulative run hours of the cooling fan are displayed.	—	—	O	—	—	—
H44	Startup frequency 1	For replacement adjustment (0000 to FFFF (hex.))	—	—	O	—	—	—
H45	Failure simulation	Change H45 to "1" to generate a pseudo failure. The setting is automatically reset to "0."	—	—	O	0	0	0
H47	Main-circuit capacitor initial failure	For replacement timing adjustment (0000 to FFFF (hex.))	—	—	O	Factory shipment setting	—	—
H48	Cumulative run hours of PC board capacitors	For replacement adjustment; change cumulative run hours (can be reset)	—	—	O	—	—	—
H49	Starting characteristics (Pick-up delay)	0.0 to 10.0 s	0.1	s	O	0.0	0.0	0.0
H50	Broken line V/f 1 (Frequency)	0.0 (Cancel), 0.1 to 400.0 Hz	0.1	Hz	×	0.0	0.0	0.0
H51	(Voltage)	0 to 240 V: AVR operation (200V class) 0 to 500 V: AVR operation (400V class)	1	V	×	0	0	0
H52	Broken line V/f 2 (Frequency)	0.0 (Cancel), 0.1 to 400.0 Hz	0.1	Hz	×	0.0	0.0	0.0
H53	(Voltage)	0 to 240 V: AVR operation (200V class) 0 to 500 V: AVR operation (400V class)	1	V	×	0	0	0
H54	Acceleration/deceleration time (jogging operation)	0.00 to 3600 s	0.01	s	O	6.00	6.00	6.00
H56	Forced stop deceleration time	0.00 to 3600 s	0.01	s	O	6.00	6.00	6.00
H61	UP/DOWN control initial value selection	0: The initial value is 0. 1: The initial value is the previous last UP/DOWN command value.	—	—	×	1	1	1
H63	Bottom limiter (Mode selection)	0: The low limit is limited with the setting of F16 (frequency limiter (low limit)) and operation continues. 1: Controlled stop if the low limit drops below the frequency limiter (low limit).	—	—	O	0	0	0
H64	(Min. frequency if limiter is activated)	0.0 (Depends on the setting of F16 (frequency limiter (low limit)) 0.1 to 60.0 Hz	0.1	Hz	O	1.6	1.6	1.6
H68	Slip compensation 1 (Condition selection)	0: Valid during acceleration/deceleration, valid at base frequency or above 1: Invalid during acceleration/deceleration, valid at base frequency or above 2: Valid during acceleration/deceleration, invalid at base frequency or above 3: Invalid during acceleration/deceleration, invalid at base frequency or above	—	—	×	0	0	0

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
H69	Regeneration prevention control (Mode selection)	0: Disabled 2: Enabled (Torque limit: cancellation valid up to 3 times the deceleration time setting) 4: Enabled (Torque limit: cancellation invalid up to 3 times the deceleration time)	—	—	O	0	0	0
H70	Overload prevention control	0.00 (Depends on selected deceleration time) 0.01 to 100.00 Hz/s, 999 (Disabled)	0.01	Hz/s	O	999	999	999
H71	Deceleration characteristics	0: Disabled 1: Enabled	—	—	O	0	0	0
H76	Torque limit (braking) (Frequency increase limiter)	0.0 to 400.0 Hz	0.1	Hz	O	5.0	5.0	5.0
H80	Current fluctuation suppression gain 1	0.00 to 0.40	0.01	—	O	0.20	0.20	0.20
H89	For manufacturer	0, 1	—	—	O	0	0	0
H90	For manufacturer	0, 1	—	—	O	0	0	0
H91	PID feedback broken line detection (C1 terminal)	0.0: Broken line detection protection disabled 0.1 to 60.0: Broken line detection time	0.1	s	O	0.0	0.0	0.0
H94	Cumulative motor run hours 1	Cumulative-time change (Can be reset)	—	—	×	—	—	—
H95	DC braking 1 (Characteristic selection)	0: Slow response 1: Quick response	—	—	O	1	1	1
H96	Priority on STOP key and start check function	0: STOP key priority function invalid, start check function invalid 1: STOP key priority function valid, start check function invalid 2: STOP key priority function invalid, start check function valid 3: STOP key priority function valid, start check function valid	—	—	O	0	0	0
H97	Alarm data clear	Change H97 to "1" to reset alarm data. The setting is automatically reset to "0."	—	—	O	0	0	0
H98	Protection and maintenance machine (Mode selection)	0 to 31 (Decimal indication at keypad; "0" and "1" of each bit indicates invalid and valid.) bit 0: Carrier frequency automatic reduction function bit 1: Protective operation upon phase lack in input bit 2: Protective operation upon phase lack in output bit 3: Main-circuit capacitor life judgment selection bit 4: Main-circuit capacity life judgment	—	—	O	19 (bit 4, 1.0=1)	19	19

A code: Alternative Motor Functions

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
A01	Max. output frequency 2	25.0 to 400.0 Hz	0.1	Hz	×	60.0	60.0	60.0
A02	Base frequency 2	25.0 to 400.0 Hz	0.1	Hz	×	50.0	50.0	50.0
A03	Base frequency voltage 2	0 V: The voltage proportionate to the source voltage is output. 80 to 240 V: AVR operation	1	V	×	200	200	200
A04	Max. output voltage 2	80 to 240 V: AVR operation	1	V	×	200	200	200
A05	Torque boost 2	0.0 to 20.0% (A03: % to base frequency voltage 2)	0.1	%	O	0.2 kW: 8.4 1.5 kW: 6.8	8.4	6.8
A06	Electronic thermal relay 2 (for motor protection) (Characteristic selection)	1: For general-purpose motors with self-cooling fan 2: For fans with forced-cooled fan	—	—	O	1	1	1
A07	(Level)	0.00 (Disabled) 1 to 135% of rated inverter output current	0.01	A	O	0.2 kW: 1.30 1.5 kW: 6.10	1.30	6.10
A08	(Thermal time constant)	0.5 to 75.0 min	0.1	min	O	5.0	5.0	5.0
A09	DC braking 2 (Starting frequency)	0.0 to 60.0 Hz	0.1	Hz	O	0.0	0.0	0.0
A10	(Level)	0 to 100% (Based on rated inverter output current)	1	%	O	0	0	0
A11	(Time)	0.00 s (Disabled), 0.01 to 30.00 s	0.01	s	O	0.00	0.00	0.00
A12	Starting frequency 2	0.1 to 60.0 Hz	0.1	Hz	O	0.5	0.5	0.5

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
A13	Load selection/ automatic torque boost/ automatic energy saving operation 2	0: Variable torque load 1: Constant torque load 2: Automatic torque boost 3: Automatic energy saving operation (variable torque load) 4: Automatic energy saving operation (constant torque load) 5: Automatic energy saving operation (automatic torque boost)	—	—	×	1	1	1
A14	Control method selection 2	0: Disabled (V/f control; without slip compensation) 1: Enabled (Dynamic torque vector control) 2: Enabled (V/f control; with slip compensation) 3: Enabled (V/f control with PG) 4: Enabled (Dynamic torque vector control with PG)	—	—	×	0	0	0
A15	Motor 2 (No. of poles)	2 to 22 poles	2	poles	×	4	4	4
A16	(Capacity)	0.01 to 30.00 kW (For motors with A39 setting being 0, 3 or 4) 0.01 to 30.00 HP (For motors with A39 setting being 1)	0.01 0.01	kW HP	×	0.2 kW: 0.20 1.5 kW: 1.50	0.20	1.50
A17	(Rated current)	0.00 to 100.00 A	0.01	A	×	0.2 kW: 1.30 1.5 kW: 6.10	1.30	6.10
A18	(Auto tuning)	0: Disabled 1: Enabled (%R1 and %X are tuned with the motor stopped.) 2: Enabled (%R1, %X and rated slip are tuned with the motor stopped, and the no-load current is tuned with the motor running.)	—	—	×	0	0	0
A19	(Online tuning)	0: Disabled 1: Enabled	—	—	O	0	0	0
A20	(No-load current)	0.00 to 50.00 A	0.01	A	×	0.2 kW: 1.06 1.5 kW: 3.01	1.06	3.01
A21	(%R1)	0.00 to 50.00%	0.01	%	O	0.2 kW: 12.95 1.5 kW: 6.55	12.95	6.55
A22	(%X)	0.00 to 50.00%	0.01	%	O	0.2 kW: 12.92 1.5 kW: 11.21	12.92	11.21
A23	(Slip compensation gain (driving))	0.0 to 200.0%	0.1	%	⊙	100.0	100.0	100.0
A24	(Slip compensation response time)	0.01 to 10.00 s	0.01	s	O	0.50	0.50	0.50
A25	(Slip compensation gain (braking))	0.0 to 200.0%	0.1	%	⊙	100.0	100.0	100.0
A26	(Rated slip)	0.00 to 15.00 Hz	0.01	Hz	×	0.2 kW: 2.33 1.5 kW: 2.00	2.33	2.00
A39	Motor 2 selection	0: Motor characteristic 0 (Fuji's 8 Series standard motor) 1: Motor characteristics 1 (HP motor) 3: Motor characteristic 3 (Fuji's 6 Series standard motor) 4: Others	—	—	×	0	0	0
A40	Slip compensation 2 (Condition selection)	0: Valid during acceleration/deceleration, valid at base frequency or above 1: Invalid during acceleration/deceleration, valid at base frequency or above 2: Valid during acceleration/deceleration, invalid at base frequency or above 3: Invalid during acceleration/deceleration, invalid at base frequency or above	—	—	×	0	0	0
A41	Current fluctuation suppression gain 2	0.00 to 0.40	0.01	—	O	0.20	0.20	0.20
A45	Cumulative motor run hours 2	Change cumulative run hours (can be reset)	—	—	×	—	—	—
A46	Starting frequency 2	For replacement timing adjustment (0000 to FFFF (hex.))	—	—	O	—	—	—

■ J code: Application Functions

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
J01	PID control (Mode selection)	0: Disabled 1: Process control use (Normal action) 2: Process control use (Inverse action) 3: Speed control (Dancer)	—	—	×	0	0	0
J02	(Remote command)	0: Keypad 1: PID command 1 3: UP/DOWN 4: Communication	—	—	×	0	0	0
J03	P (gain)	0.000 to 30.000 times	0.001	Times	○	0.100	0.100	0.100
J04	I (Integration time)	0.0 to 3600.0 s	0.1	s	○	0.0	0.0	0.0
J05	D (Differentiation time)	0.00 to 600.00 s	0.01	s	○	0.00	0.00	0.00
J06	(Feedback filter)	0.0 to 900.0 s	0.1	s	○	0.5	0.5	0.5
J10	(Anti-reset wind up)	0 to 200%	1	%	○	200	200	200
J11	(Alarm output selection)	0: Absolute value alarm 1: Absolute value alarm (With hold) 2: Absolute value alarm (With latch) 3: Absolute value alarm (With hold and latch) 4: Deviation alarm 5: Deviation alarm (With hold) 6: Deviation alarm (With latch) 7: Deviation alarm (With hold and latch)	—	—	○	0	0	0
J12	(Upper limit alarm (AH))	–100% to 100%	1	%	○	100	100	100
J13	(Lower limit alarm (AL))	–100% to 100%	1	%	○	0	0	0
J18	(PID output limiter, upper limit)	–150% to 150%, 999 (Cancel)	1	%	○	999	999	999
J19	(PID output limiter, lower limit)	–150% to 150%, 999 (Cancel)	1	%	○	999	999	999
J56	(PID speed command filter)	0.00 to 5.00 s	0.01	s	○	0.10	0.10	0.10
J57	(Dancer reference position)	–100 to 0 to 100%	1	%	○	0	0	0
J58	(Dancer reference position detection width)	0: PID constant changeover cancel 1 to 100%: Manual setting	1	%	○	0	0	0
J59	P (Gain) 2	0.000 to 30.000 times	0.001	Times	○	0.100	0.100	0.100
J60	I (Integration time) 2	0.0 to 3600.0 s	0.1	s	○	0.0	0.0	0.0
J61	D (Differentiation time) 2	0.00 to 600.00 s	0.01	s	○	0.00	0.00	0.00
J62	(PID control block selection)	Decimal indication on keypad bit 0: PID output polarity 0: Positive (Addition). 1: Negative (Subtraction) bit 1: Output ratio correction selection 0: Speed command correction. 1: Ratio correction	1	—	×	0	0	0
J63	Overload stop function (Detection value)	0: Torque 1: Current	—	—	○	0	0	0
J64	(Detection level)	20 to 200%	1	%	○	100	100	100
J65	(Mode selection)	0: Disabled 1: Controlled stop 2: Coast to stop 3: Mechanical stopper	—	—	×	0	0	0
J66	(Mode)	0: Valid during constant-speed operation or deceleration 1: Valid during constant-speed operation 2: Valid in all modes	—	—	○	0	0	0
J67	(Timer time)	0.00 to 600.00 s	0.01	s	○	0.00	0.00	0.00
J68	Brake signal (Releasing current)	0 to 200%	1	%	○	100	100	100
J69	(Releasing frequency)	0.0 to 25.0 Hz	0.1	Hz	○	1.0	1.0	1.0
J70	(Releasing timer)	0.0 to 5.0 s	0.1	s	○	1.0	1.0	1.0
J71	(Application frequency)	0.0 to 25.0 Hz	0.1	Hz	○	1.0	1.0	1.0
J72	(Application timer)	0.0 to 5.0 s	0.1	s	○	1.0	1.0	1.0

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
J73	Position control (Start timer)	0.0 to 1000.0 s	0.1	s	O	0.0	0.0	0.0
J74	(Start point: High order digit)	–999 to 999	1	p	O	0	0	0
J75	(Start point: Low order digit)	[P], 0 to 9999	1	p	O	0	0	0
J76	(Position preset: High order digit)	–999 to 999	1	p	O	0	0	0
J77	(Position preset: Low order digit)	[P], 0 to 9999	1	p	O	0	0	0
J78	(Creep speed changeover point: High order)	0 to 999	1	p	O	0	0	0
J79	(Creep speed changeover point: Low order)	0 to 9999	1	p	O	0	0	0
J80	(Creep speed)	0 to 400 Hz	1	Hz	O	0	0	0
J81	(Stopping position: High order digit)	–999 to 999	1	p	O	0	0	0
J82	(Stopping position: Low order digit)	0 to 9999	1	p	O	0	0	0
J83	(Completion width)	0 to 9999	1	p	O	0	0	0
J84	(End timer)	0.0 to 1000.0 s	0.1	s	O	0.0	0.0	0.0
J85	(Inertial run correction)	0 to 9999	1	p	O	0	0	0
J86	(Stopping position command method)	0, 1	—	—	O	0	0	0
J87	(Position presetting condition)	0, 1, 2	—	—	×	0	0	0
J88	(Position detection direction)	0, 1	—	—	×	0	0	0
J90	Overload stop, torque limit P (Gain)	0.000 to 2.000, 999	0.001	—	O	999	999	999
J91	Function, torque limit 1 (Integration time)	0.001 to 9.999 s, 999	0.001	s	O	999	999	999
J92	Current control level	50.0 to 150.0%	0.1	%	O	100.0	100.0	100.0

■ Y code: LINK Functions

Function code	Name	Setting range	Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
							Carrier (0.2 kW)	Lifter (1.5 kW)
y01	RS-485 setting 1 (Station address)	1 to 255	1	—	×	1	1	1
y02	(Mode selection upon error)	0: Immediate Er8 trip 1: Operation for timer time then Er8 and trip 2: Communication retry during operation for timer time and, if communication is not restored, Er8 and trip or, if communication is restored, continuation of operation 3: Continuation of operation	—	—	○	0	0	0
y03	(Timer setting time)	0.0 to 60.0 s	0.1	s	○	2.0	2.0	2.0
y04	(Transmission speed)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	—	—	○	3	3	3
y05	(Data length)	0: 8 bits 1: 7 bits	—	—	○	0	0	0
y06	(Parity bit)	0: None. (In case of RTU, 2 stop bits) 1: Even. (In case of RTU, 1 stop bit) 2: Odd. (In case of RTU, 1 stop bit) 3: None. (In case of RTU, 1 stop bit)	—	—	○	0	0	0
y07	(Stop bits)	0: 2 bits 1: 1 bit	—	—	○	0	0	0
y08	(Communication shutdown detection time)	0: Not detected 1 to 60 s	1	s	○	0	0	0
y09	(Response interval)	0.00 to 1.00 s	0.01	s	○	0.01	0.01	0.01
y10	(Protocol selection)	0: Modbus RTU protocol 1: SX protocol (Loader protocol) 2: Fuji's universal inverter protocol	—	—	○	1	1	1
y11	RS-485 setting 2 (Station address)	1 to 255	1	—	×	1	1	1
y12	(Mode selection upon error)	0: Immediate ErP trip 1: Operation for timer time then ErP and trip 2: Communication retry during operation for timer time and, if communication is not restored, ErP and trip or, if communication is restored, continuation of operation 3: Continuation of operation	—	—	○	0	0	0
y13	(Timer setting time)	0.0 to 60.0 s	0.1	s	○	2.0	2.0	2.0
y14	(Transmission speed)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	—	—	○	3	3	3
y15	(Data length)	0: 8 bits 1: 7 bits	—	—	○	0	0	0
y16	(Parity bit)	0: None. (In case of RTU, 2 stop bits) 1: Even. (In case of RTU, 1 stop bit) 2: Odd. (In case of RTU, 1 stop bit) 3: None. (In case of RTU, 1 stop bit)	—	—	○	0	0	0
y17	(Stop bits)	0: 2 bits 1: 1 bit	—	—	○	0	0	0
y18	(Communication shutdown detection time)	0: Not detected 1 to 60 s	1	s	○	0	0	0
y19	(Response interval)	0.00 to 1.00 s	0.01	s	○	0.01	0.01	0.01
y20	(Protocol selection)	0: Modbus RTU protocol 2: Fuji's universal inverter protocol	—	—	○	0	0	0
y98	Bus function (Mode selection)	Frequency command / Operation command 0: As per H30 / As per H30 1: Bus command / As per H30 2: As per H30 / Bus command 3: Bus command / Bus command	—	—	○	0	0	0

Function code	Name	Setting range		Increment	Unit	Change when running	Inverter maker factory shipment setting	Toyota setting	
		Frequency command	Operation command					Carrier (0.2 kW)	Lifter (1.5 kW)
y99	Link function for supporting data input (Mode selection)	0: As per H30 and y98	As per H30 and y98	—	—	O	0	0	0
		1: Loader command	As per H30 and y98						
		2: As per H30 and y98	Loader command						
		3: Loader command	Loader command						

5.2.3 Setting Thermal

OL3 set value: 0.48 A

5.2.4 Setting of Safety Controller

Settings of the rotary switch of the safety controller “CR101” are as follows:

Function.A............“0”
Function.B............“0”

5.3 Descriptions of Individual Operation and Functions

5.3.1 Automatic Operation

[1] When Automatic Operation is Enabled

(1) When all equipment is at the origin:
Start operation by making the automatic operation start procedure from STEP0 (standby for full bobbin signal).

(2) When the equipment is at return completed position (carrier at stop position C5, lifter at the origin, and the fork at stop position F1):
Restart operation by making automatic operation restart procedure from STEP6.

(3) If operation was interrupted by depressing the step stop button during automatic operation (when STEP No. is 1 to 20):

Depressing the step stop button stops the FL after completing the current step.

Make automatic operation restart procedure to restart operation from the interrupted step.

(4) When the FL operation was interrupted by a trouble during doffing:

■ **FRD trouble**

FRD operation signal is turned OFF to stop the FL operation.

After making corrective action for the trouble, reset the FRD alarm and restart operation by making automatic operation restart procedure.

■ **FL trouble**

FRD call-in signal is turned OFF to stop the FL operation.

After making corrective action for the trouble, restart operation by depressing the doffing switch of the FL.

[2] Sequence During Automatic Operation

- Operating sequence during normal condition is as indicated in the operation line drawing (see the attachment).

  STEP 0 is the standby state for full bobbin signal from the FL.
  STEPs 1 to 20 are the doffing state.

  If position transfer, and/or return to the origin are executed during the doffing, the doffing will be forcibly ended and STEP No. returns to 0.

5.3.2 Manual Operation

Operation of the respective equipment is as described in 4. Operation.

[1] Operation During Position Transfer

Operation is enabled only when the conditions stated in [3] Simultaneous doffer position transfer enabled range in the following page are met.
Since there exists location to which doffing position cannot be transferred under the conditions per [3], use the handle and move the location in this case.

- **Operation**

  - Transfer to a target position in the speed stated in the following table:

Carrier

	Target position					
	0	1	2	3	4	5
Normal speed	Speed 3 (60 Hz)	Speed 3 (60 Hz)	Speed 2 (30 Hz)	Speed 3 (60 Hz)	Speed 3 (60 Hz)	Speed 3 (60 Hz)
Speed in the deceleration range before stopping	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)

Lifter

	Target position				
	0	1	2	3	4
Normal speed	Speed 3 (45 Hz)	Speed 3 (45 Hz)	Speed 2 (30 Hz)	Speed 2 (30 Hz)	Speed 2 (30 Hz)
Speed in the deceleration range before stopping	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)	Speed 1 (10 Hz)

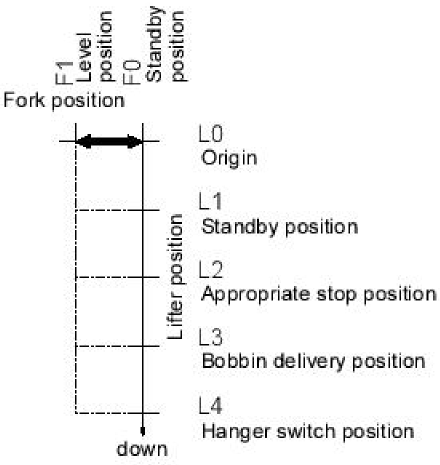
NOTE: ( ) indicate the inverter commanded frequency.

[2] Manual Operation of FL

Operation will be enabled only when the conditions [3] stated in the following page are met. In the case of the doffer unused mode (FRD operating signal is disregarded), the FL operates irrespective of the status.
(For manual FL operation when FRD is off.)

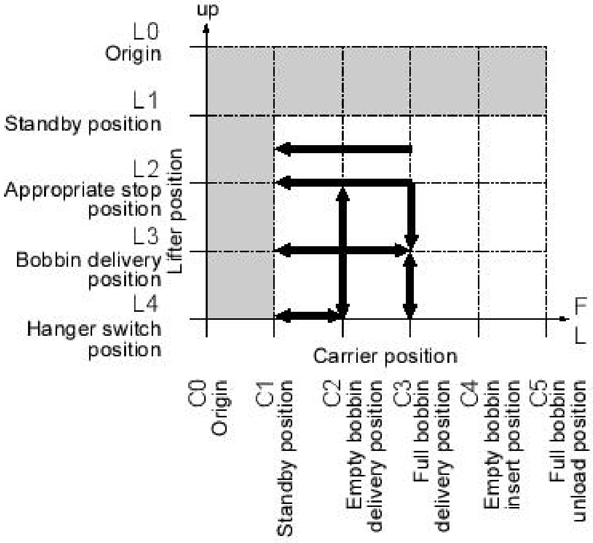
[3] Simultaneous Doffering Position Transfer Enabled Range (During Manual Operation)

Fork transfer enabled range


F1
Level
position
F0
Standby
position
Fork position
L0
Origin
L1
Standby position
L2
Appropriate stop position
L3
Bobbin delivery position
L4
Hanger switch position
Lifter position
down

- Transfer enabled only when the carrier is at the origin

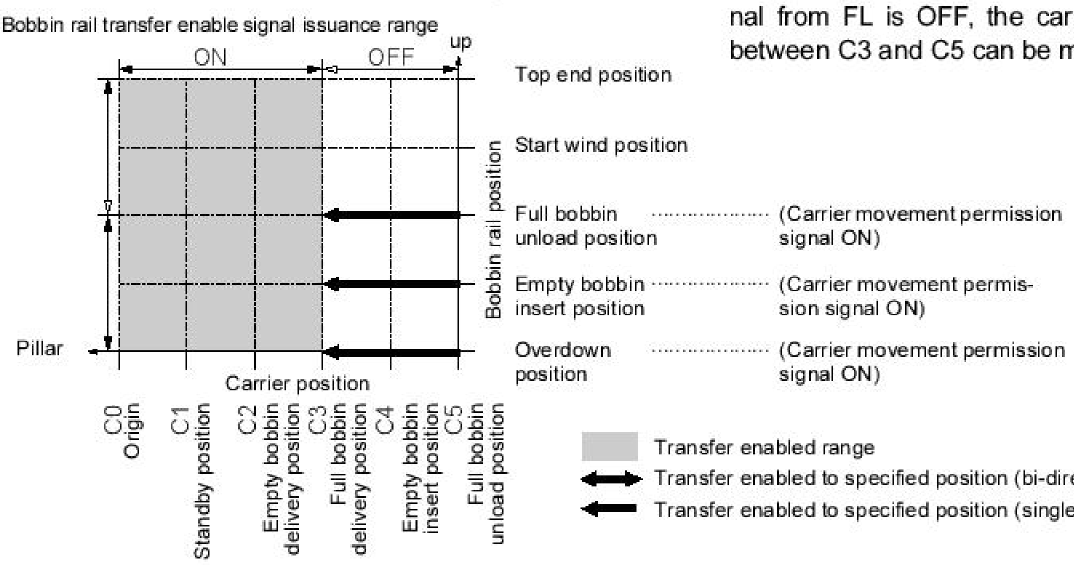
Carrier/Lifter transfer enabled range


up
L0
Origin
L1
Standby position
L2
Appropriate stop position
L3
Bobbin delivery position
L4
Hanger switch position
Lifter position
F
L
Carrier position
C0
Origin
C1
Standby position
C2
Empty bobbin delivery position
C3
Full bobbin delivery position
C4
Empty bobbin insert position
C5
Full bobbin unload position

The carrier and lifter are enabled to transfer only when the fork is in level position. Transfer is limited by the following bobbin rail position of the **FL**

NOTE: If the stopped position is outside the movable range because of a defect, careful movement by handle operation is necessary to avoid damage to the equipment.

Bobbin rail and carrier transfer enabled range


Bobbin rail transfer enable signal issuance range
ON
OFF
up
Top end position
Start wind position
Full bobbin unload position
(Carrier movement permission signal ON)
Empty bobbin insert position
(Carrier movement permission signal ON)
Overdown position
(Carrier movement permission signal ON)
Bobbin rail position
Pillar
Carrier position
C0
Origin
C1
Standby position
C2
Empty bobbin delivery position
C3
Full bobbin delivery position
C4
Empty bobbin insert position
C5
Full bobbin unload position

- Even if the carrier movement permission signal from FL is OFF, the carrier in the range between C3 and C5 can be moved backward.

▨ Transfer enabled range
⟷ Transfer enabled to specified position (bi-directional)
← Transfer enabled to specified position (single direction only)

5.3.3 Saving and Recovering

When the carrier stops as the result of detection of collapsed bobbin shoulder, the carrier and the fork can be temporarily saved at the origin while making corrective action. After the corrective action, the carrier returns to the target transfer position C5 by the recovery function. (During transfer, monitoring of collapsed shoulder is carried on in the sections for detection.)

(1) Conditions for enabling saving and/or recovery
Saving and recovery are enabled likewise when the carrier stops for any error other than the collapsed shoulder in STEP 4 to 5 (while the carrier transfers from C0 to C5) during the doffing in automatic operation.

(2) Saving operation

- The carrier moves to the carrier stop position C3.

NOTES:

- If the carrier stops because of emergency stop, etc. during the saving operation, it can transfer to the saving position by depressing the save button again.
- If either carrier, fork or lifter is moved manually, the carrier is disabled to be saved.
  In such a case, return all the equipment to the origin and run automatic operation from the start.

(3) Recovery operation

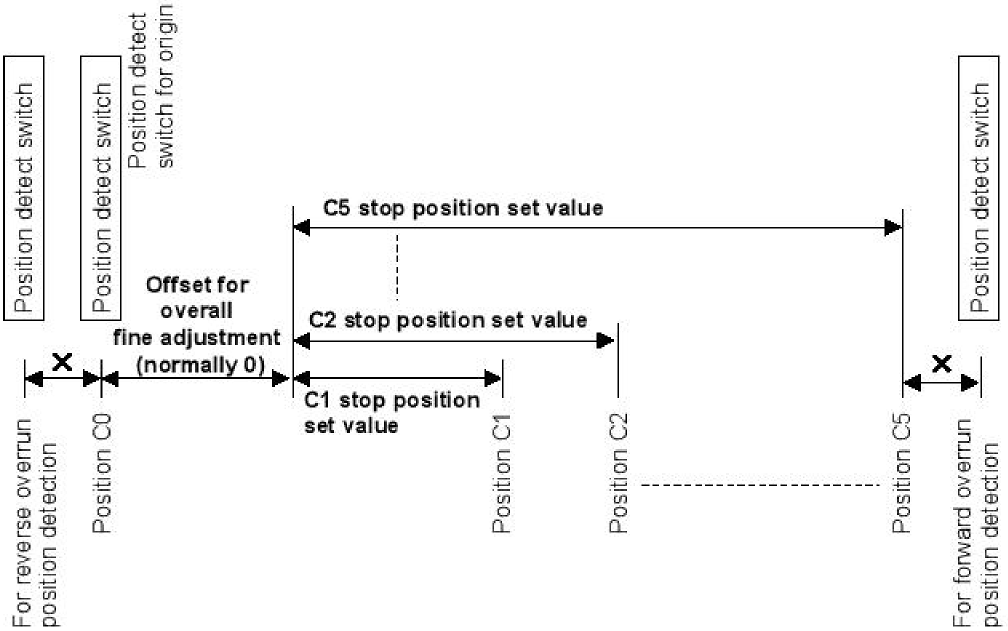
- If recovery button is depressed while saving the carrier or it is at the save position, recovery operation follows.
- When restarting automatic operation after the recovery, operation starts from the beginning of the execution STEP 6 and command to the FL is transmitted.
- Operating sequence
  First stage: Safely check by the area sensor
  Second stage: Transfer to the fork stop position F1
  Third stage: Transfer to the carrier stop position C5
  (meanwhile monitoring of collapsed shoulder is run in the section for detection.)

5.3.4 Return to Machine Datum

(1) Carrier

- **Carrier position relations**

The following indicate the relation of positions of respective stop positions, position detection switch and the origin. The offset is for making fine adjustment of overall position at sensor replacement, etc.


Position detect switch
Position detect switch
Position detect switch for origin
Position detect switch
C5 stop position set value
Offset for overall fine adjustment (normally 0)
C2 stop position set value
C1 stop position set value
X
X
For reverse overrun position detection
Position C0
Position C1
Position C2
Position C5
For forward overrun position detection

- **Origin recovery operation**

1) Perform carrier returning to its origin (see 4.1.11).
2) End if at the origin. If not, move it toward the origin in low speed (inverter output 10 Hz = about 1 m/min).
3) At the moment the position detect signal from origin detector is turned ON, the counter is zero-cleared and the carrier stops at the same time.
4) When the counter is zero-cleared, the carrier will be in the origin recovery state.

NOTE: Before returning to the origin, always place the carrier in front (on the FL side) of the origin detecting proximity switch.

(2) Lifter

- **Origin recovery operation**

1) Return the lifter to its origin (see 4.1.11).
2) Operation ends if the lifter is at the origin. If not at the origin (PRS200 is off), the lifter rises at low speed (inverter output 10 Hz = about 1 m/min.)
3) When the origin signal (PRS200) is ON, the lifter stops.

5.3.5 Detecting Carrier Position

Find the current position by measuring the encoder pulse with the high-speed counter of the sequencer. When the counter value is as follows, it is judged that the carrier is at the stop position.

Stop position	Counter value		Actual dimension
C0	(Origin detecting proximity switch ON)		
C1	Stop position setting	±11	Equivalent to ±3 mm
C2	Stop position setting	±7	Equivalent to ±2 mm
C3	Stop position setting	±11	Equivalent to ±3 mm
C4	Stop position setting	±7	Equivalent to ±2 mm
C5	Stop position setting	±7	Equivalent to ±2 mm

5.3.6 Detecting Lifter Position

The current position of the lifter is recognized with the inverter direction of revolution and respective sensor signals.

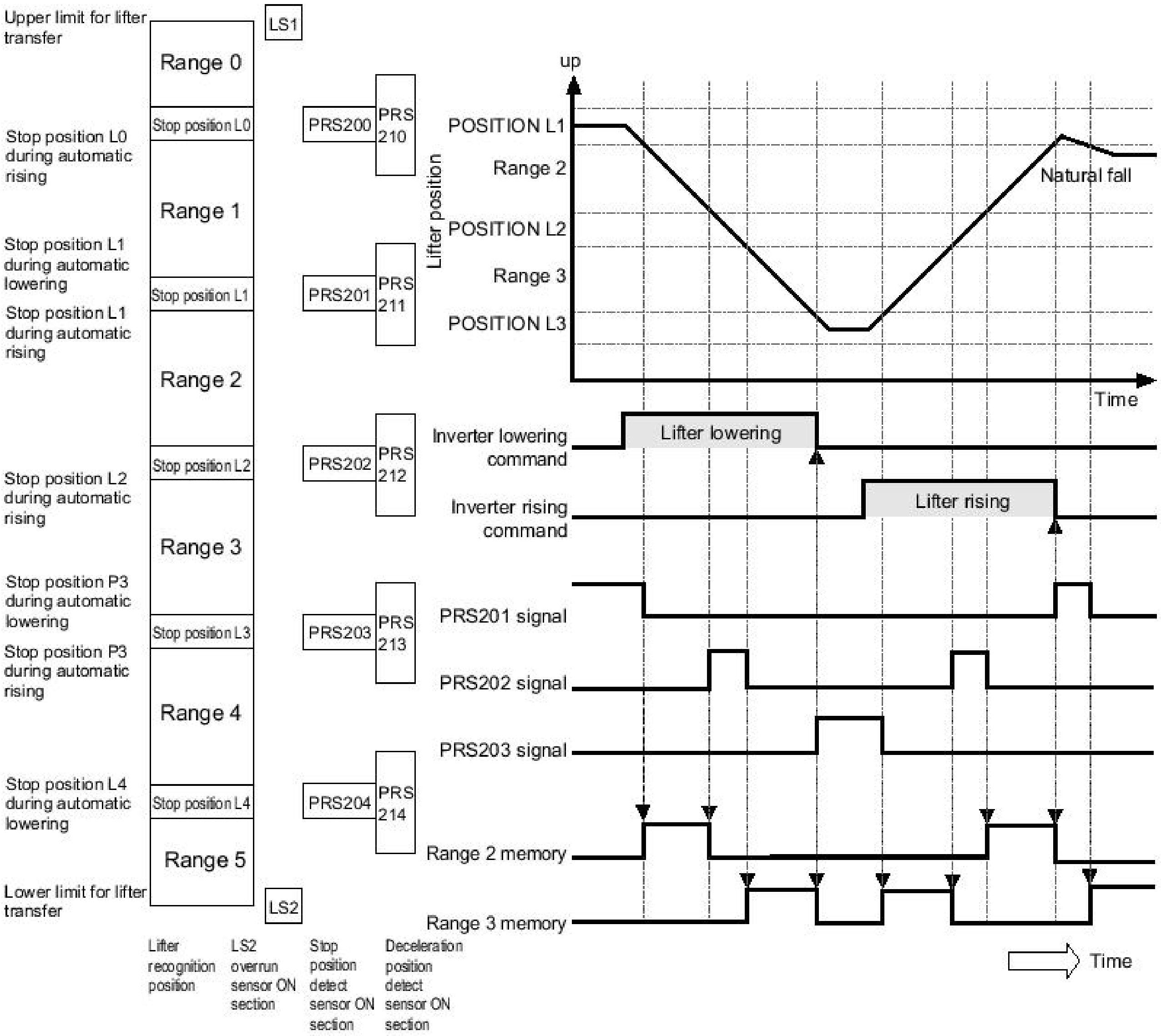
(1) Recognition of respective positions
When respective stop position detect sensors are ON, the lifter is at the corresponding stop position. The range to be recognized as the stop position is the section where the sensor is ON.

Position detect sensor No.	Corresponding stop position
PRS100	L0
PRS101	L1
PRS102	L2
PRS103	L3
PRS104	L4

(2) Recognition of area other than the stop position (see the diagram below)

Detection of the lifter having entered respective areas is recognized with the direction of the inverter revolution command and the falling of respective PRS. When the PRS is falling and the revolution command is for the rising direction, the lifter position is recognized in the range above the respective stop positions, and if the command is for the lowering direction, below the respective stop positions.

The lifter is judged as having left the range with the input signal from respective stop positions.


Upper limit for lifter transfer
LS1
Range 0
Stop position L0
Stop position L0 during automatic rising
PRS200
PRS 210
Range 1
Stop position L1 during automatic lowering
Stop position L1
Stop position L1 during automatic rising
PRS201
PRS 211
Range 2
Stop position L2
Stop position L2 during automatic rising
PRS202
PRS 212
Range 3
Stop position P3 during automatic lowering
Stop position L3
Stop position P3 during automatic rising
PRS203
PRS 213
Range 4
Stop position L4 during automatic lowering
Stop position L4
PRS204
PRS 214
Range 5
Lower limit for lifter transfer
LS2
Lifter recognition position
LS2 overrun sensor ON section
Stop position detect sensor ON section
Deceleration position detect sensor ON section
up
Lifter position
POSITION L1
Range 2
POSITION L2
Range 3
POSITION L3
Natural fall
Time
Inverter lowering command
Lifter lowering
Inverter rising command
Lifter rising
PRS201 signal
PRS202 signal
PRS203 signal
Range 2 memory
Range 3 memory
Time

Lifter recognition position and the sensor ON position

Example of changes in respective range recognition memory to the variation of the lifter position

Fig. 10 Lifter position detection

5.3.7 Detecting Abnormal Stop Position

If the following two conditions are met when the carrier (lifter) stops at respective stop positions, it will be processed as an error:

- Time elapsed 0.5 sec and over after the command to the motor has been turned OFF.
- The carrier (lifter) is not at the stop position.

5.3.8 Detecting Abnormal Lifter Sensor

Abnormality of the sensor for detecting the lifter stop/deceleration position is detected.

(1) Detecting abnormal sensor input
Normal combinations are as indicated in the following table:

	P0 deceleration	P1 deceleration	P2 deceleration	P3 deceleration	P4 deceleration	P0 stop	P1 stop	P2 stop	P3 stop	P4 stop
Normal 1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Normal 2	ON	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF	OFF
Normal 3	OFF	ON	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF
Normal 4	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF
Normal 5	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON/OFF	OFF
Normal 6	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON/OFF

In the case of ON/OFF, it is normal irrespective of ON or OFF.
If a signal other than the above combination is received, the sensor will be judged as abnormal.

(2) Detecting stop sensor fault (signal is constantly OFF)
When the lifter passes respective stop positions, it will be judged abnormal if the stop sensor fails to turn ON after the deceleration sensor turns ON, and the deceleration sensor turns OFF.

NOTE: If the stop and deceleration sensors for the same stop position become faulty simultaneously, the machine stops for the timeout error.

5.3.9 Checking Abnormal Encoder

No checking of the encoder is made for 3 seconds after it started transfer. When 3 seconds elapsed, counter is checked for increment/decrement every second. Checking ends when deceleration starts (inverter command for speed 1 is given) or at emergency stop.

To judge if the encoder is in normal condition:

(1) When the inverter command is for 60 Hz:
The encoder is normal when increment/decrement of the counter per second is between 364 and 460 pulses.

(2) When the inverter command is for 30 Hz:
The encoder is normal when increment/decrement of the counter per second is between 180 and 208 pulses.

Cases outside the above two conditions are detected as abnormal.

5.3.10 Detecting Bobbin with Collapsed Shoulder

When the shoulder should collapse during spinning, the end of the fork interferes the collapsed roving to disable the bobbin delivery. When interfered, the bobbin tilts and shields the sensor light. By detecting this shielding of the light, bobbin with collapsed shoulder is detected.
Since the optical axis from the sensor is shielded by part of the fork depending on the carrier position, a section is set for conducting detection of collapsed bobbin.

To set up the detection section, points for starting and ending detection are set from the panel.

- Start detection: when the carriage travels to the detection starting position.
- End detection: when the carriage travels to the detection ending position.

(1) Photoelectric switch
The photoelectric switch for detecting collapsed bobbin shoulder becomes effective when the carrier enters the collapsed bobbin detection section in STEP4 (for taking a full bobbin) during automatic operation (or recovery).
When the photoelectric switch becomes effective, the projector is turned ON and the signal from the optical detector is detected.

(2) Operation upon detecting abnormality
When the photoelectric switch for detecting collapsed shoulder is turned OFF (shielded) while the detect signal is effective, carry on the following steps:

1) Stop the carrier.

2) After stopping (= generating stop command to the inverter), stand by for 3 seconds (T31) until the bobbin stops swaying to prevent detection error. During the standby, the photoelectric switch signal is invalidated.

3) Check the output of the photoelectric switch. If the photoelectric switch signal is

ON: restart doffing operation, and if
OFF: enter emergency stop state for detecting collapsed shoulder.

4) After restarting doffing with the photoelectric signal ON, if the photoelectric switch is turned OFF (shielded) again during the effective period of collapsed bobbin detection signal, enter the emergency stop state for the collapsed bobbin shoulder detected.

5.3.11 Detecting No Empty Bobbin Delivery

Presence of a bobbin on the hanger is checked to confirm that an empty bobbin is correctly delivered to the hanger.

(1) Photoelectric switch
Upon receiving the signal from the lifter at the stop position L2 (PRS202), the projector projects the beam of light from the front row for 0.3 second. With the intervals of 0.6 second, it projects the light from the rear row for 0.3 second.
The optical detector makes the signal from the front row effective when the front row projector is turned ON, and the rear row effective when the rear row projector is turned ON.

(2) Detection
A bobbin is judged as being present when the beam is shielded (the sensor output is turned OFF) for 0.2 second or longer while the front row signal is effective. This is the same for the rear row. When the lights from both the front and rear rows are shielded, the detection is judged as being normal.

5.3.12 Detecting Empty Bobbin Delivery Error

After delivering an empty bobbin from the hanger to the fork, it is checked that no bobbin remains on the hanger undelivered.

(1) Photoelectric switch
The projector first projects the beam of light from the front row for 0.3 second. With the intervals of 0.6 second, the rear row projects the light for 0.3 second.
The optical detector makes the signal from the front row effective while the front row projector is turned ON, and the rear row effective while the rear row projector is ON.

(2) Detection
A bobbin is judged as being present when the beam is shielded (the sensor output is turned OFF) for 0.2 second or longer while the front row signal is effective. This is the same for the rear row. When the lights from both the front and rear rows are not shielded, the detection is judged as being normal.

5.3.13 Detecting Full Bobbin Delivery Error

It is checked that no full bobbin remains undelivered on the fork after the fork delivers full bobbin to the hanger.

(1) Photoelectric switch
The projector first projects the beam of light from the front row for 0.3 second. With the intervals of 0.6 second, the rear row projects the light for 0.3 second.
The optical detector makes the signal from the front row effective while the front row projector is turned ON, and the rear row effective while the rear row projector is ON.

(2) Detection
A bobbin is judged as being present when the beam is shielded (the sensor output is turned OFF) for 0.2 second or longer while the front row signal is effective. This is the same for the rear row. When the lights from both the front and rear rows are not shielded, the detection is judged as being normal.

(3) Operation upon detection
When judged as abnormal, the lifter travels to the stop position L1, and then outputs an alarm and stops.

5.3.14 Safety Device

(1) Door switch

When the door is open, power supply is cut off and the machine enters the emergency stop state. The door switch will be constantly effective when the power is turned ON.

To reset, use the safety door switch reset button (yellow).

NOTE: When you are away from the loom without resetting the safety door switch after closing the door, automatic doffing is disabled when the bobbin becomes full. Always remember to reset the safety door switch.

For the safety, always observe the following item.

Reset the switch always after checking that no other person and/or obstacle are within the working area.

(2) Area sensor

Area sensor will be effective for 20 seconds before the alarm chime is sounded after the FL transmits a full bobbin signal. Run the circuit check before detection. Detection is made with the area sensor in front of the loom. Upon elapse of 20 seconds, the area sensor output will be invalidated.

(3) Entry detection

During operation (during manual travel and the doffing in automatic operation), the sensor supervises entry from behind the carrier. If entry is detected, it stops doffing immediately. After completing the doffing, the power is turned off for both the projector and the optical detector.

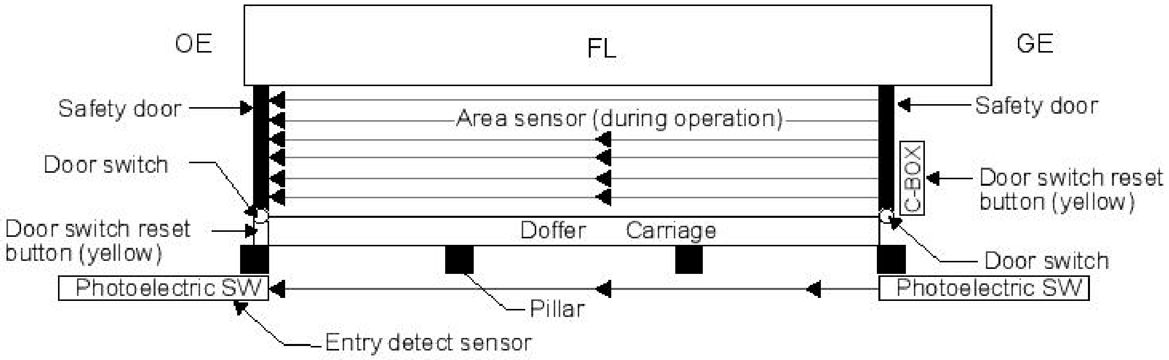
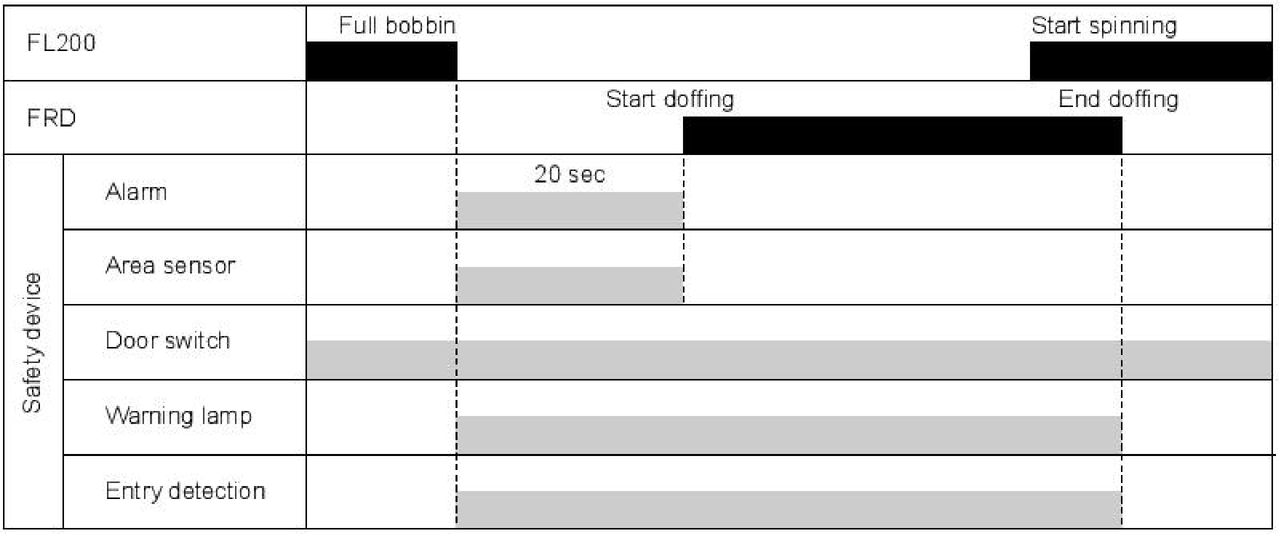

OE
FL
GE
Safety door
Area sensor (during operation)
Safety door
Door switch
C-BOX
Door switch reset button (yellow)
Door switch reset button (yellow)
Doffer
Carriage
Door switch
Photoelectric SW
Photoelectric SW
Pillar
Entry detect sensor

Fig. 7 Sketch drawing of safety sensor layout

REFERENCE: Operating period of respective safety devices



5.3.15 Communication with FL200

FRD data is exchanged with the FL200 by I/O sides using the parallel lines (each four lines for input and output).

(1) Call signal [FL200 to FRD]
Signal for regulating the normality of FRD operation is transmitted.

- During automatic operation
  Doffing starts when the signal changes from OFF to ON (or doffing restarts when the FRD call signal was turned OFF during the doffing), and executes the doffing while the signal is ON.
- During other than automatic operation
  Individual transfer is enabled while the signal remains ON.
- If the signal is turned OFF (L level) during the doffing, the FL outputs an error message and stops. While the machine is down in this state, the message is erased when the signal changes from OFF to ON. While the signal is OFF, automatic and manual operation are inhibited and the power supply to the motor is stopped (except during recovery operation from a trouble during doffing).

  At this time, “FRD in Operation” signal and the status remain unchanged.

(2) Permission signal [FL200 to FRD]
Signal being turned ON/OFF limits the range of transfer for the carrier (see the possible range of transfer of FRD position in the preceding section).

(3) “In Operation” signal [FRD to FL200] (Only when using the doffer mode. Disregarded when not in use.)
When this signal is turned OFF during the doffing (during the period from the time FRD call signal is turned ON till the bobbin rail transfer enabled signal is turned ON), the FL outputs an alarm message, inhibits the FL200 operation and the loom stops.

(4) Permission signal (FRD to FL200. Only when using the doffer mode. Disregarded when not in use.)
Depending on the carrier position, information signal concerning the transfer of bobbin rail of FL200 is transmitted.
When the carrier is on the side of FL200 than the stop position C3, this signal is OFF. During the period the signal is OFF, bobbin rail is disabled to travel.

(5) FRD output data signal line and FRD input data signal line

1) FRD output signal (to FL)

In operation	Permission	Command 1	Command 2	Meaning of signal
ON	OFF	OFF	OFF	No signal
ON	OFF	ON	OFF	Travel command to full bobbin unload position
ON	OFF	OFF	ON	Travel command to the lowest end position
ON	OFF	ON	ON	Travel command to empty bobbin insert position
ON	OFF→ON	OFF	OFF	Spinning enabled signal

2) FRD input signal (from FL)

Call	Permission	Command 1	Command 2	Meaning of signal
ON/OFF	OFF	OFF	OFF	No signal
OFF→ON	OFF	OFF	OFF	Full bobbin signal
ON	OFF	ON	OFF	Travel command to full bobbin unload position
ON	OFF→ON	ON	OFF	Full bobbin unload position signal
ON	OFF	OFF	ON	Traveling signal to the lowest end position
ON	OFF→ON	OFF	ON	Lowest end position signal
ON	OFF	ON	ON	Traveling signal to the empty bobbin insert position
ON	OFF→ON	ON	ON	Empty bobbin insert position signal

5.3.16 Communication with the Carrier

Data is exchanged between the FRD controller and the carrier by using parallel lines (one each for input and output, and two spare lines each for input and output).

The signals comprise transportation OK signal, doffing OK signal and the spare signal lines (each two lines for input and output).

(1) Transportation OK signal [FRD → Carrier]
Transmits signal for judging the normality of the transporting operation.

- When doffing is completed or when transport request button is pressed, this signal turns ON.
  The carrier system registers the transport request when this signal turns ON.
- If this signal is turned OFF while the transport request is being registered, transportation will be interrupted.

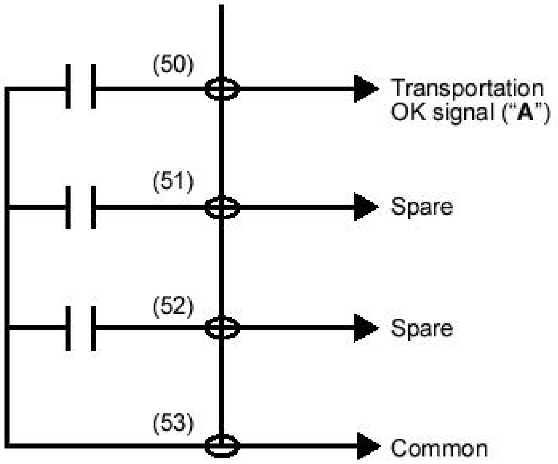
NOTE: The interruption may be disabled depending on the position of a mobile type transport.

(2) Doffing OK signal [Carrier → FRD]
Transmits signal for judging the normality of FRD operation.

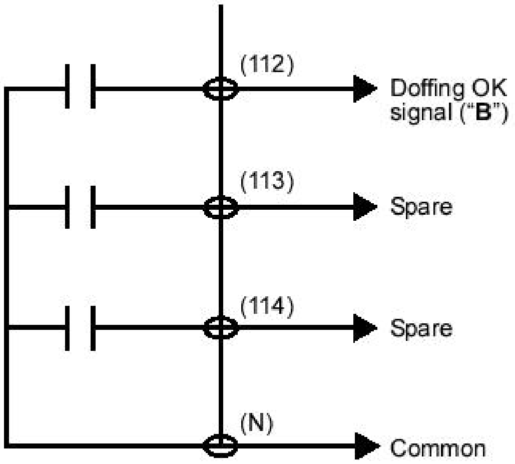
- This signal is turned ON when transportation is completed and the lifter is enabled to travel.
  Doffing in automatic operation and the manual operation of the lifter are enabled only when the doffing OK signal is turned ON.
- Upon receiving the transportation OK signal and ending the transport request registration, the transportation system turns this signal OFF.

REFERENCE: Signals Interface

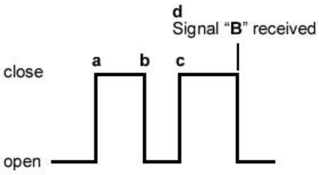
(1) FRD to Carrier
3 points (including spare)


(50)
Transportation OK signal ("**A**")
(51)
Spare
(52)
Spare
(53)
Common

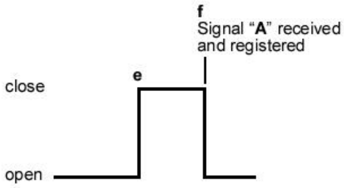
(2) Carrier to FRD
3 points (including spare)


(112)
Doffing OK signal ("**B**")
(113)
Spare
(114)
Spare
(N)
Common

REFERENCE: Details on the signals (FRD to Carrier)

Signal name and specifications	Signal timing	Operation on the carrier side
Transportation OK signal — "**A**" (Unloading/Loading enabled) (1) Doffing operation ends and ready for unloading/loading → contact close (2) Operator depresses *registration button (Manual operation) → contact close (3) Unloading/Loading disabled → contact open (4) Empty bobbin already loaded (Signal "**B**" received) → contact open * Unloading/Loading registration button is provided on the equipment supplied by Toyota. After depressing this button, "close" state of this signal will be held until the unloading/loading is disabled or the loading of empty bobbin is completed.	 **a**: Registration of unloading/loading (transportation OK) **b**: Unloading/loading is disabled depending on the state on Toyota side. **c**: Transportation OK again **d**: Signal "**B**" received, The empty bobbin loading operation is properly completed.	(1) When this signal is "closed" at point "**a**", unloading/loading is registered. (2) When this signal is "open" at point "**b**", actual unloading/loading operation is interrupted/stopped. (3) When this signal is "closed" again at point "**c**", actual unloading/loading operation is restarted. (4) Registration of unloading/loading operation on EJ side is held from the point "**a**" to point "**b**". The point "**c**" is unrelated to the registration of unloading/loading. **NOTE:** (5) Canceling unloading/loading registration The registration can be cancelled from the control panel on the EJ side.

REFERENCE: Details on the signals (Carrier to FRD)

Signal name and specifications	Signal timing	Operation on the FRD side
Doffing OK signal – "**B**" (Loading of empty bobbin is properly completed.) (1) Unloading operation is properly completed (no bobbin in the sector). Loading operation is properly completed (empty bobbin in the prescribed position). → contact close "Close" this signal after checking that loading/unloading operation is property made on EJ side. (2) "Closed" state of this signal will be held until signal "**A**" is received and the unloading/loading is registered. (3) If for any reason unloading/loading is registered by the PC on EJ side before signal "**A**" is received and the unloading or loading of a sector of the pertinent roving frame is attempted or if attempt is made to manually operate the automatic motor to make unloading or loading, change this signal to "open." After this, if the condition of is met, turn this signal to "close" again.	 f Signal "A" received and registered e close open **e**: Empty bobbin loading operation is properly completed **f**: Signal "**A**" received and registration completed	While this signal is in "close" state, doffing operation can be made (both automatic and manual operation) **INDIVIDUAL OPERATION:** Manual doffing operation using the switch **NOTE:** If this signal is in "close" state, the doffer side judges that a sector with empty bobbin is inside the hanger rail. And the doffer side judges that each sector is in the prescribed position.

5.3.17 Action for Power Failure

If the carrier or bobbins are on the optical axis of the area sensor when a power failure occurs, the area sensor cannot be initialized if the above-mentioned state continues to be present, disabling the doffer operation.

OPERATION:

(1) When each equipment is at the origin and obstacles are in the optical path of the area sensor, turn the power OFF (CB1 off) and eliminate the obstacles from the optical path of the area sensor.

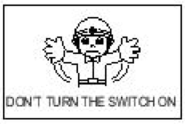
Then turn the power ON again.

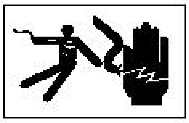
(2) If power failure occurs during automatic operation
Cancel the area sensor and complete the doffing by step operation.

(3) If power failure occurs during manual operation
Cancel the area sensor, and the maintenance staff returns each equipment manually to the origin. Then remove the bobbins from the fork and eliminate obstacles from the optical path of the area sensor. Turn the power ON in this state.

- For (2) and (3), see Section 6 Subsection 6.6 Emergency Stop Tripped by Area Sensor.

6. TROUBLESHOOTING


DON'T TURN THE SWITCH ON



⚠ CAUTION

Carry out the troubleshooting by observing the following:

FL200 INSTRUCTION MANUAL, Section S.1 "Safe Work"

S.1.2 "Rules for Safe Operation"

S.1.3 "Rules for Maintenance Work"

S.1.4 "Rules for Handling and Inspecting Electrical Units."

Since the inverter is used, the capacitor is charged if the main breaker is turned OFF.
Carry on the work that requires direct touching on the wire 10 minutes or longer after the power is turned OFF.

6.1 Types of Error Messages and Corrective Actions

Messages indicated on the FRD operation panel comprise the following two statuses.
When a message is indicated, check the contents and take necessary corrective action as may be needed.

NOTE: Since errors are detected by the sequencer, error detection will be disabled if the sequence fails.

No. of message	Content	Requirement of reset for operation
E-1-** to E-4-**	• Status where equipment has error. • Trouble is notified with an error message and the lamp. • Stops power supply to the motor drive line (to check the error content) except the inverter error.	Reset required after corrective action
W-5-**	• Equipment has no abnormality (entry error, etc.) • Abnormality is notified with error message.	Reset required after corrective action

(1) Simultaneous generation of abnormalities
If further alarm/warning is generated to the loom to which alarm/warning has been already generated, an error message of the highest priority is indicated. Generated alarm/warning is cancelled from the alarm/warning of the higher order as the alarm reset button is depressed.

(2) Action for abnormality generated

If the sequencer fails: see the manual of the sequencer.

If the sequencer is normal: see the action column in 6.2 Error Messages List.

6.2 Error Messages List

(1) Error message on the FRD side (alarm state)

*1

Error message	Content	Action to take	Detailed descriptions	Automatic operation restart	Step interlock	Manual return to origin
E-1-1 Abnormal communication line	Abnormality detected on the communication line at power ON (including the case where the FL is not turned ON)	• If the FL is not turned ON, turn it ON. • Reset the alarm. If error message reappears, check communication line for any disconnection, etc.		–	–	–
E-1-2 Abnormal communication	A command was output to FL during doffing via communication line but no reply received from FL.	• Reset the alarm. • Set the FRD to automatic operation status and output full bobbin signal from FL.		○	–	–
		• If error message persists, check the communication line for disconnection, etc.		×	△	○
E-1-3 Abnormal inverter	Trouble generated to the carrier or lifter inverter.	• Check the error code with the inverter display. • Take the error corrective action appropriate to the error code.	6.5 Action for Inverter Error	△	△	○
E-1-4 Fork Motor Overload	Thermal was tripped because of overload of the fork motor	• Check the fork motor for phase-to-phase shortcircuit and/or grounding. If no abnormality detected, check for abnormal bearing on the unit motor basis and for any abnormality on the load side. Recover the thermal relay after taking corrective action, restart operation and observe the state of operation.		○	△	○
E-1-5 Abnormal encoder	Encoder pulse per unit time during the traveling exceeds the control reference of –5% to +10%.	• Check if set rate and the control reference rate coincides. • Check the carrier mechanical drive system for any abnormality.	3.3.5 Checking the Encoder	×	×	○
		• Investigate the encoder waveform. If any abnormality detected, replace the encoder.	2.2.7 Rotary Encoder			
E-1-6 Abnormal lifter position detect sensor	Abnormality generated with the lifter stop/deceleration position detect	• Check the output of respective lifter sensors by using the sequencer LED.	3.3.4 Checking Respective Detect Sensors	×	×	○
		• Replace sensors with abnormality.	3.3.6 Adjusting the Starting Position of Lifter Arm Speed Reduction 3.3.7 Adjusting the Stop Position of Lifter Arm			
E-1-7 Abnormal fork position detect sensor	Both position detect sensors of the fork are turned off.	• Check the output of the fork sensor by using the sequencer LED.	3.3.4 Checking Respective Detect Sensors	×	×	○
		• Replace sensors with abnormality.	3.3.14 Adjusting the Detect Device of Fork Stop Position			
E-1-8 Abnormal muting relay CR102	Muting relay deposited	Execute alarm reset after replacing the muting relay.		×	○	–

*1 How to restart after generation of abnormality:

To restart automatic operation:	Doffing can be restarted automatically from the position the operation was interrupted. ○: Enabled (power is ON while error corrective action is being taken). △: Enabled if the power is not turned OFF while error corrective action is being taken). ×: Disabled. –: Not required.
To run step operation:	After canceling the area sensor output, automatic operation is made step by step by using the step operation button. ○: Enabled. △: Enabled if each equipment was not manually operated when the power was turned OFF. ×: Disabled. –: Not required.
To manually return to the origin:	Automatic operation will restart after the maintenance staff moved respective equipment to the origin by making visual inspection. Bobbins should be manually delivered. No bobbin should be present on the fork when the latter is transferred. ○: Enabled. △: Enabled if each equipment was not manually operated when the power was turned OFF. ×: Disabled. –: Not required.

Error message	Content	Action to take	Detailed descriptions	Automatic operation restart	Step interlock	Manual return to origin
E-1-9 Abnormal projection stop relay CR106	Area sensor projection stop relay deposited	• Check wiring of terminal No. 14C for disconnection. • Replace the area sensor projection stop relay.	 3.3.12 Adjusting the Obstacle Detect Sensor	×	○	–
E-1-10 Abnormal area sensor controller reset relay CR108	Area sensor controller reset coil deposited	• Check wiring of terminal No. 129 for disconnection. • Replace the area sensor controller reset relay.		×	○	–
E-1-11 Abnormal carrier overrun sensor	Front and rear carrier overrun sensors turned ON simultaneously.	• Check that no bolts and/or other metal are present near the carrier overrun sensors (PRS101 and PRS102). • Check the wiring for disconnection. • If no abnormality detected as the result of the above checking, replace the sensors.	3.3.4 Checking Respective Detect Sensors 3.3.10 Adjusting the Carrier Position	×	○	–
E-1-12 Abnormal lifter overrun sensor	Front and rear lifter overrun sensors turned ON simultaneously.	• Check that lifter overrun sensors (LS1 and LS2) have no abnormality. • Check that wiring has no disconnection. • If no abnormality detected as the result of the above checking, replace the sensors.	3.3.4 Checking Respective Detect Sensors 3.3.8 Adjusting the Overrun of Lifter Arm	×	○	–
W-2-1 Safety door tripped emergency stop	Safety door is open	• Close the safety door, check that no person is within the working area, and then cancel the alarm by depressing reset button (yellow). • Adjust the door switch.	5.3.14 Safety Device 3.3.2 Adjusting the Safety Door Switch	○	–	–
W-2-2 Area sensor tripped emergency stop	Obstacle detected in the working area in front of the carrier when doffing started	• Remove obstacle and person from the working area. • If the safety door was opened, carry out the procedure required by emergency stop tripped by the safety door. • Adjust the area sensor.	6.6 Emergency Stop Tripped by Area Sensor 3.3.12 Adjusting the Obstacle Detect Sensor	○	–	–
E-2-3 Emergency stop tripped by emergency stop button	Emergency stop button depressed	• Eliminate the cause for which emergency button (red) was depressed and reset the lock.		○	–	–
W-2-4 Emergency stop by detected entry	Obstacle detected in the working area behind the carrier during doffing	• Remove the obstacle from the working area.	5.3.14 Safety Device	○	–	–
E-2-5 FRD call signal missing	Abnormality generated with FL and FRD operation disabled.	• Reset abnormal FL. • If FL has no error, check the communication line for disconnection.	5.3.15 Communication with FL200	○	–	–
W-2-6 Carrier signal missing	Carrier started unloading/loading bobbins	• During unloading/loading of bobbin: Wait for the transportation to end and restart operation. • Not during unloading/loading of bobbin: Check that the power supply to the transport is turned ON. Check for disconnection between FRD and carrier system.	5.3.16 Communication with the Carrier	○	–	–
E-3-1 Carrier floated	Carrier runs on an obstacle, etc.	• Remove the obstacle. • Check if the clearance of floating detect switch is correct.	3.3.15 Adjusting the Floating Carrier Detect Device	○	△	○

Error message	Content	Action to take	Detailed descriptions	Automatic operation restart	Step interlock	Manual return to origin
E-3-2 Carrier stop position incorrect	Carrier failed to stop within prescribed stop range.	• Investigate the carrier brake. • Check the inverter set value. • Check the gear and timing belt.	5.2.2 Setting Inverter 2.2.6 Carrier Motor	×	×	○
E-3-3 Lifter stop position incorrect	Lifter failed to stop within prescribed stop range.	• Investigate the lifter brake. • Check the inverter set value.	5.2.2 Setting Inverter	×	×	○
E-3-4 Carrier overrun	Carrier exceeded the mechanical operation limit position.	• Investigate the carrier brake. • Check the inverter set value.	5.2.2 Setting Inverter	×	×	○
		• Investigate the carrier overrun sensor. • Check the overrun limit position. After taking actions, reset the alarm and take recovery procedure.	3.3.10 Adjusting the Carrier Position			
E-3-5 Lifter overrun	Lifter exceeded the operation limit position.	• Investigate the lifter brake. • Investigate the lifter set value.	5.2.2 Setting Inverter	×	×	○
		• Investigate the lifter overrun limit switch. • Check the overrun limit position. After taking actions, reset the alarm and take recovery procedure.	3.3.8 Adjusting the Overrun of Lifter Arm			
E-3-6 Carrier current position unknown	When the power is ON, carrier was outside the origin (except during power failure)	Execute return to the origin with the operation panel.	5.3.4 Return to Machine Datum	×	×	○
E-3-7 Power failure stop	Doffer controller was turned OFF during automatic operation because of power failure.	• Invalidate the area sensor by using the key switch in the control box without moving the doffer while the power is OFF. Then complete the doffing operation by step operation.	5.3.17 Action for Power Failure 6.6 Emergency Stop Tripped by Area Sensor	×	○	○
E-3-8 Timeout	Each operation failed to end within prescribed time	Check the inverter set value.If during the lifter travel, check the stop sensor.	5.2.2 Setting Inverter	×	×	○
E-4-1 Bobbin with deformed shoulder detected	Bobbin fell down during fork insertion	• If caused by a bobbin with deformed shoulder, remove the bobbin. • If caused by wrong fork position, adjust the fork position.	6.7.1 Corrective Action for Deformed Bobbin Shoulder	○	–	–
		• If caused by other than above, 1 Check for fluff, etc. that shield the light. (especially on top of fork) 2 Check the optical axis of the sensors and check for any fault. 3 Check the flyer stop position.	5.3.10 Detecting Bobbin with Collapsed Shoulder 3.3.13 Adjusting the Detect Device of Bobbin with Collapsed Shoulder			
W-4-2 Empty bobbin delivery fault	Empty bobbin not loaded to the lifter	• If the bobbin is on the lifter: Check the optical axis of the sensor. Check for any fault. • If the bobbin is not on the lifter: Return all the equipment to the origin. Supply the lifter with the bobbin and restart automatic operation.		○	–	–
E-4-3 Lifter empty bobbin delivery error	Empty bobbin delivery error from the lifter to the fork generated	• When empty bobbin remained on the lifter: Move the bobbin from the lifter to the fork. Check the bobbin hanger for any fault. If the same error persists, adjust the lifter position and fork height.	6.7.2 Corrective Action of Empty Bobbin Delivery Error to the Fork	○	–	–
		• When empty bobbin was not on the lifter: Check the optical axis of the sensor. Check for any fault.	3.3.11 Adjusting the Delivery Error Detect Sensors			

Error message	Content	Action to take	Detailed descriptions	Automatic operation restart	Step interlock	Manual return to origin
E-4-4 Carrier full bobbin delivery error	Full bobbin delivery error from the fork to the lifter generated	• When full bobbin remained on the fork: Remove the bobbin from the lifter to the fork. Check the bobbin hanger for any fault. If the error persists, adjust the lifter position and the fork height.	6.7.4 Corrective Action for Full Bobbin Delivery Error to the Lifter	○	–	–
		• If full bobbin was not on the lifter: Check the optical axis of the sensor and check for any fault.	3.3.11 Adjusting the Delivery Error Detect Sensors			

(2) Warning status

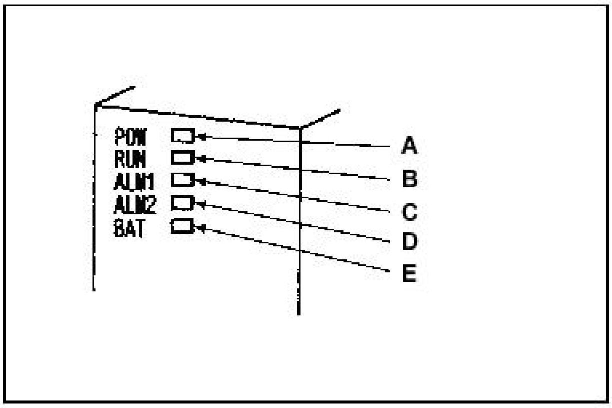
No.	Error message	Content	Action to take
W-5-1	Transfer target position incorrect	Travel instructed to a position where collision may occur.	• Change the target for travel. Or, • Send for the maintenance staff and have him travel it in the maintenance mode. The maintenance staff carries out travel by avoiding collision by visual inspection.
W-5-2	Automatic operation disabled	Interlocked operation attempted when the carrier, lifter and fork are not at the origin or saving position or outside the position where interlocking was interrupted.	Automatic operation is not possible. Carry out one of the following: • Return all equipment of doffer to the origin, then proceed with automatic operation from STEP0. • Maintenance staff manually carries on doffing. • Carry out manual doffing.
W-5-3	STEP operation disabled	Interlocked operation attempted when the carrier, lifter and fork are not at the origin or saving position or outside the position where interlocking was interrupted.	Step operation is not possible. Carry out one of the following: • Return all equipment of doffer to the origin. Then validate the area sensor and carry on automatic operation from STEP0. • Maintenance staff manually carries out doffing. • Carry on manual doffing.
W-5-4	Lifter transfer disabled by the transport	Attempted to move the lifter while delivering bobbins	• During bobbin delivery: Wait until the transportation is completed, then restart operation. • Not during bobbin delivery: Check that the transport is turned ON. Check for disconnection between the FRD and feed system.
W-5-5	Simultaneous transfer disabled	Attempted to set multiple equipment in setting transfer target for the carrier, lifter and fork during position transfer.	Since only one equipment can be transferred at one time, carry out one of the following: • Transfer the equipment to the currently set target position, then set up the following equipment. • Return the currently set target transfer position to the current position, then set the transfer of other equipment.
W-5-6	Carrier stop position set data incorrect	Set values of respective carrier positions not meeting $C1 \leq C2 \leq C3 \leq C4 \leq C5$	Reset carrier stop position set data.
W-5-7	Deformed shoulder detect section set data incorrect	Set values for deformed shoulder detect section not meeting the detect start position ≤ detect end position ≤ C5	Reset the deformed shoulder detect section set data.

(3) Error messages on the roving frame side
Messages are indicated on the FL operation panel.
(Not indicated on the FRD panel.)

No.	Error message	Content	Action to take	Detailed descriptions	Automatic operation restart	Step interlock	Manual return to origin
E-65	Bobbin insert error	Bobbin is not properly inserted to the bobbin wheel. (Detected at starting transfer from the empty bobbin insert position to the start winding position)	• Insert tilted empty bobbin to the bobbin wheel properly.	6.7.3 Corrective Action for Empty Bobbin Delivery Error to the FL	○	–	–
			• If the error occurs frequently with a particular spindle: Adjust the fork position. Check the projection of the fork magnet. Check the fitting of the bobbin wheel and the cap.	2.2.11 Adjusting Longitudinal Position of Fork 2.2.12 Adjusting Height Position of Fork			
			• If the error occurs with multiple spindles: Check the carrier stop position.	3.3.10 Adjusting the Carrier Position			
E-80	FRD stopping	Transfer enable signal from FRD is OFF	• If the carrier is on the FL side than the stop position C3, reverse the carrier and transfer beyond the stop position C3. • If the carrier is behind the stop position C3, stop automatic operation if the FRD is in automatic operation. • If caused by other than the above, check the communication line.		–	–	–
E-81	Bobbin rail transfer disabled	FRD inhibited bobbin rail transfer	• Transfer the carrier to between C0 and C3. • If trouble persists after the transfer, check the communication line.		–	–	–
E-82	Doffing interrupted	Cause for the stopping generated on the FL side during doffing	Correct FRD error. If FRD is not faulty, check the communication line.		–	–	–
E-83	Abnormal FRD communication	Failed initial communication check with the doffer. Or command from the doffer was interrupted during operation.	Check abnormality such as the disconnection of communication line, etc.	See FRD error E-1-1 Abnormal communication line and E-1-2 Abnormal communication.			
E-84	Falling of FRD bobbin detected	• Bobbin fell down during bobbin delivery from FRD to FL (during travel from the overdown position to the empty bobbin insert position). • There is a fallen bobbin on the bobbin rail upon arrival at the winding start position.	• Pick up the bobbin and insert to the FL bobbin wheel. **NOTE:** Check the empty bobbin inserting position on the wheel for any fouling, surface defect or deformation.	6.7.3 Corrective Action for Empty Bobbin Delivery Error to the FL	○	–	–
			• If the trouble occurs frequently with a particular spindle: 1 Adjust the fork position. (in machine width, longitudinal and height directions) 2 Check the form for any bend. 3 Check the fork magnet projection. 4 Check the fitting of FL bobbin wheel and the cap.	2.2.11 Adjusting Longitudinal Position of Fork 2.2.12 Adjusting Height Position of Fork			
			• If the trouble occurs with multiple spindles: Check the carrier stop position.	3.3.10 Adjusting the Carrier Position			

6.3 Corrective Action for Sequencer Error

(1) Content of LED indicators of the basic unit

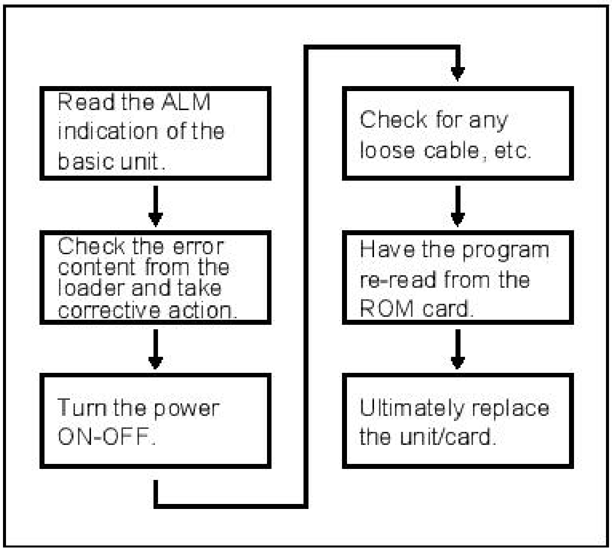

POW
RUN
ALM1
ALM2
BAT
A
B
C
D
E

A	"POW"	lights up upon power ON.
B	"RUN"	lights up during operation. [Turns out when stopped by the loader, at ALM1 or at hardware failure of the unit]
C	"ALM1"	lights up at critical failure and stops operation.
D	"ALM2"	lights up at minor failure but continues operation. "RUN" remains lit if only ALM2 is lit, while ALM1 being out.
E	"BAT"	lights up when the battery is not provided or battery voltage has dropped.

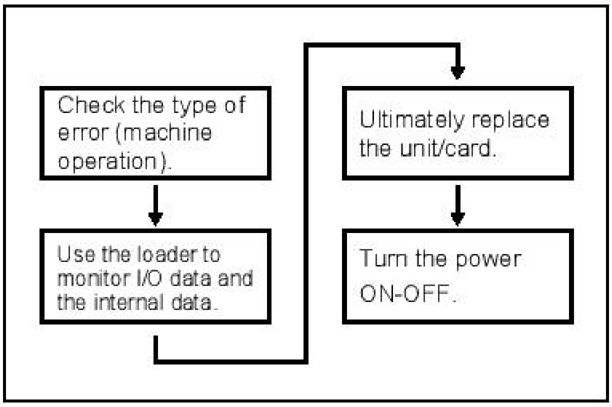
(2) Steps of troubleshooting

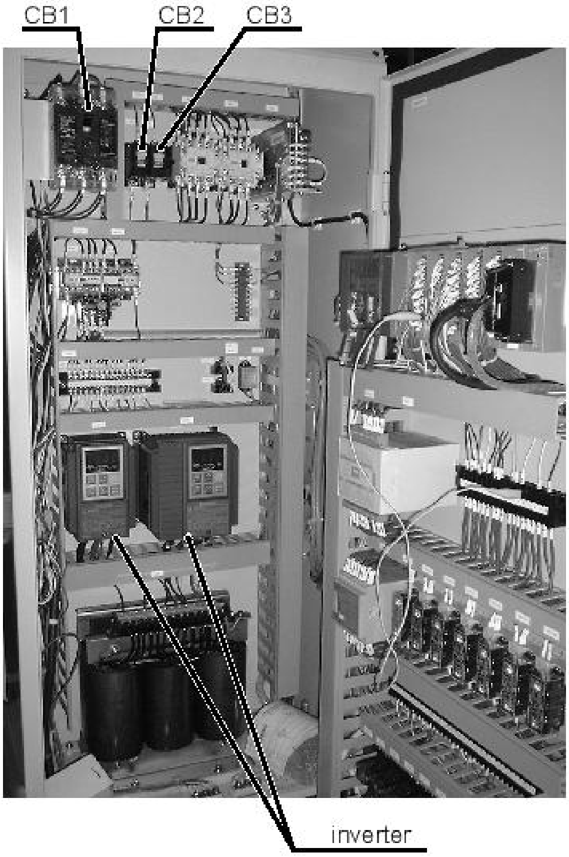
1) When indicated by alarm

NOTE: For the content of errors and relative actions, refer to the manuals for the sequencer and the loader.


Read the ALM indication of the basic unit.
Check the error content from the loader and take corrective action.
Turn the power ON-OFF.
Check for any loose cable, etc.
Have the program re-read from the ROM card.
Ultimately replace the unit/card.

2) When not indicated by alarm


Check the type of error (machine operation).
Use the loader to monitor I/O data and the internal data.
Ultimately replace the unit/card.
Turn the power ON-OFF.



6.4 Action for Tripped Circuit Breaker

The power circuit is provided with a circuit breaker to prevent the burning of equipment and wiring because of shortcircuit on the side of the load.

(1) When CB1 is tripped, check the electrical equipment and wiring downstream of CB1 for any abnormality.

- Carrier inverter (INV1)
- Lifter inverter (INV2)
- Carrier brake pack (BP1)
- Lifter brake pack (BP2)
- Fork brake pack (BP3)

(2) When CB2 is tripped, check the electrical equipment and wiring downstream of CB2 (100 VAC) for any abnormality.

- 24-V switching regulator (PS1)
- Sequencer (SEQ1)

(3) When CB3 is tripped, check the electrical equipment and wiring downstream of CB3 for any abnormality.

- Display unit (DISP)
- Detect sensors (photoelectric switch, position detect switch, and encoder)

6.5 Action for Inverter Error

6.5.1 When the Inverter Error Occurs

- When safety device works, the inverter is immediately tripped (output stop). The LED indicator indicates the name of fault and stops the motor free-run. For the contents of alarm and indication, see (1) Inverter error list.
- Tripped state will remain until the cause of tripping is removed or reset instruction is input from RESET key or the control circuit terminal RST.
- Past four events of protective operation activation are stored in memory. Refer to alarm data "6AL" in the program mode menu to check.
  (For details of the operation method, refer to alarm data "6AL" in the program mode menu.)
- Pressing V key allows you to read the historical contents of past protective action even while the current protective operation is indicated.

(1) Inverter error list

Protective functions to be tripped with alarm indication

Alarm code	Alarm name	Refer to	Alarm code	Alarm name	Refer to
OC1	Overcurrent protection	1)	OH1	Heat sink overheat protection	6)
OC2			OH2	External alarm	7)
OC3			OH4	Motor protection (PTC thermistor)	8)
OU1	Overvoltage protection	2)	dbH	Braking resistor overheat protection	9)
OU2			OL1	Motor 1 overload protection	10)
OU3			OLU	Inverter overload protection	11)
LU	Undervoltage protection	3)	Er1	Memory error	12)
Lin	Input phase loss protection	4)	Er2	Keypad communication error	13)
OPL	Output phase loss protection	5)	Er3	CPU error	14)

1) OCn Overcurrent protection

Phenomenon The inverter output current momentarily exceeded the overcurrent level.

OC1 Overcurrent occurred during acceleration.
OC2 Overcurrent occurred during deceleration.
OC3 Overcurrent occurred during constant-speed operation.

Cause	Check and remedy
1 Inverter output terminals are short circuited.	Disconnect cables from the inverter output terminals (U, V and W) and measure the phase-to-phase resistance of motor wires. Check for a low phase-to-phase resistance. → Remove the short-circuiting part in the wires or relaying terminal, or remove the motor itself.
2 Ground fault in inverter output circuit	Remove cables from the inverter output terminals (U, V and W) and perform a Megger test. → Remove the ground fault in the wires or relaying terminal, or remove the motor itself.
3 Too large a load	Measure the motor current and trace the current trend. Examine that the measurement is larger than the designed and calculated system load. → If an overload is found, reduce the load or choose an inverter having a larger capacity.
	Check the current trend if the current shows a sudden change. → If the current changes suddenly, reduce the load fluctuation or choose an inverter having a larger capacity. → Enable the instantaneous overcurrent limit (H12=1).
4 Too short acceleration time	Calculate the torque necessary for acceleration/deceleration, based on the moment of inertia of the load and acceleration/deceleration time and check if the result is suitable. → Check if the acceleration/deceleration time settings (F07 and F08) are adequate.
5 Malfunction caused by noise	Check the noise suppression measures (grounding state, control/main circuit wires and location). → Take noise suppression measures. For details, refer to “Appendix A” of “FRENIC-Multi User’s Manual.” → Connect a surge absorber to the coil, solenoid and so on of electromagnetic contactors that can be the source of noise.

2) OUn Overvoltage protection

Phenomenon The DC link circuit voltage exceeded the overvoltage detection level.
OU1 Overvoltage occurred during acceleration.
OU2 Overvoltage occurred during deceleration.
OU3 Overvoltage occurred during constant-speed operation.

Cause	Check and remedy
1 The source voltage exceeds the inverter specification range.	Measure the input voltage. → Reduce the source voltage to within the specification range.
2 The input power includes surge.	If the phase advancing capacitor is turned on or off or thyristor converter is activated in the same power system, the input voltage may show an abrupt rise (surge). → Install a DC reactor.
3 The deceleration time is too short when compared with the moment of inertia of the load.	Calculate the deceleration torque according to the moment of inertia of the load and deceleration time. → Check if the deceleration time setting (F08) is adequate. → Enable regeneration prevention control (H69=2, 4) or enable deceleration characteristics (H71=1). → Enable torque limit (F41). → Change the base frequency voltage (F05, A03) to "0" to improve the brake performance.
4 Too short acceleration time	Cause sudden acceleration and check if an overvoltage alarm is caused. → Check if the acceleration time setting (F07) is adequate.
5 Malfunction caused by noise	Check if the DC link circuit voltage at the time of generation of overvoltage is within the overvoltage level. → Take noise suppression measures. For details, refer to "Appendix A" of "FRENIC-Multi User's Manual." → Connect a surge absorber to the coil, solenoid and so on of the electromagnetic contactor that may be a source of noise.

3) LU Undervoltage protection

Phenomenon The DC link circuit voltage fell below the undervoltage level.

Cause	Check and remedy
1 A momentary power failure occurred.	→ Reset the alarm. → To restart the motor without causing an alarm, change the F14 data (restart after momentary power failure, mode selection) to "4" or "5," depending on the load.
2 Too short interval before the power is turned on again (if F14=1)	Check if the power is turned on with the control power turned on (check the keypad indication for the state). → Wait until the keypad indication is turned off before turning the power on.
3 The source voltage is below the inverter specification range.	Measure the input voltage. → Raise the source voltage to within the specification range.
4 The power supply circuit includes a broken device or wiring error.	Measure the input voltage and determine the broken device or wiring error. → Replace the broken device or correct the wiring error.
5 A large starting current flows through another load connected in the same power system, reducing the source voltage temporarily.	Measure the input voltage to check voltage fluctuation. → Examine the power system.
6 The in-rush current of the inverter reduces the source voltage due to the poor capacity of the power supply transformer.	Check if the alarm is caused when the molded case circuit breaker, earth leakage breaker (with overcurrent protection function) or electromagnetic contactor is turned on. → Examine the capacity of the power supply transformer.

4) **Lin Input phase loss protection**

Phenomenon An input phase loss or large phase-to-phase imbalance in the power supply was judged.

Cause	Check and remedy
1 Broken wire in input wires	Measure the input voltage. → Repair or replace the input wires.
2 Poorly tightened inverter input terminal	Check if the screw of the inverter input terminal is loose. → Retighten to the recommended tightening torque.
3 Too large phase-to-phase imbalance in 3-phase power supply	Measure the input voltage. → Install an AC reactor (ACR) to reduce the phase-to-phase imbalance.

NOTE: You can use function code H98 to disable input phase loss protection.

5) **OPL Output phase loss protection**

Phenomenon Output phase loss protection was activated.

Cause	Check and remedy
1 Broken wire in output wires	Measure the output current. → Replace the output wires.
2 Broken wires in motor winding	Measure the output current. → Replace the motor.
3 Poorly tightened inverter output terminal	Check if the screws of the inverter output terminals are loose. → Retighten to the recommended tightening torque.

6) **OH1 Heat sink overheat protection**

Phenomenon The heat sink was too hot.

Cause	Check and remedy
1 The ambient temperature exceeds the inverter specification range.	Measure the ambient temperature. → Improve ventilation of the panel and take other measures to reduce the ambient temperature.
2 Blocked cooling air path	Check if the heat sink is clogged. → Clean.
3 Service life expiration or breakage of cooling fan	Check the cumulative run hours of the cooling fan. → Replace the cooling fan.
	Visually check if the cooling fan operates correctly. → Replace the cooling fan.
4 Too large a load	Measure the output current. → Reduce the load. (Adjust the driving system.)

7) **OH2 External alarm**

Phenomenon An external alarm was input ("THR").
(If external alarm input "THR" is selected at one of digital input terminals X1-X5, FWD and REV)

Cause	Check and remedy
1 Setting error	Check if "external alarm" is allocated to one of unused terminals among E01, E02, E03, E04, E05, E98 and E99. → Change the allocation.
	Check if the logic of "THR" specified for E01, E02, E03, E04, E05, E98 or E99 and the logic of the external signal are in consistency. → Change to the correct logic.

8) OH4 Motor protection (PTC thermistor)

Phenomenon The motor was too hot.

Cause	Check and remedy
1 Setting error	The thermistor (mode selection) (H26) was active though no PTC thermistor is used. → Disable the thermistor (mode selection) (H26).

9) dbH Braking resistor overheat protection

Phenomenon Thermal protection for the braking resistor was activated.

Cause	Check and remedy
1 Function code (F50, F51) data setting error	Check the specifications of the braking resistor. → Check if the function code data (F50 and F51) is correct.

10) OL1 Motor 1 overload protection

Phenomenon Electronic thermal protection for motor overload detection was activated.

Cause	Check and remedy
1 The characteristics of the electronic thermal relay do not match the overload characteristics of the motor.	Check the motor characteristics. → Check if the function code data (P99, F10 and F12) is adequate.
2 The level of the electronic thermal relay is inadequate.	Check the continuous allowable current of the motor. → Examine the function code data (F11 and A07) and correct.
3 Too short acceleration/ deceleration time	Calculate the acceleration/deceleration torque and acceleration/deceleration time according to the moment of inertia of the load and acceleration/ deceleration time. → Check if the acceleration/deceleration time settings (F07, F08 and H56) are adequate.
4 Too large a load	Measure the output current. → Reduce the load (adjust the driving system).

11) OLU Inverter overload protection

Phenomenon The inside of the inverter was too hot.

Cause	Check and remedy
1 The ambient temperature of the inverter exceeds the specification range.	Measure the ambient temperature. → Improve panel ventilation and take other measures to lower the ambient temperature.
2 Too short acceleration/ deceleration time	Calculate the necessary acceleration/deceleration torque and acceleration/ deceleration time according to the moment of inertia of the load and acceleration/deceleration time. → Check if the acceleration/deceleration time settings (F07 and F08) are adequate.
3 Too large a load	Measure the output current. → Reduce the load (adjust the driving system).
4 Blocked cooling air path	Check if the heat sink is clogged. → Clean.
5 Service life expiration or breakage of cooling fan	Check the cumulative run hours of the cooling fan. → Replace the cooling fan.
	Visually check if the cooling fan operates correctly. → Replace the cooling fan.
6 Too large a leak current	Measure the leak current. → Install an output circuit filter (OFL).

12) Er1 Memory error

Phenomenon An error was caused in data writing.

Cause	Check and remedy
1 The power was turned off while function code data is written (during initialization or data duplication), resulting in a low control voltage.	Perform H03 to initialize data and, after initialization is finished, press the PRG/RESET key to reset the alarm. → Restore the initialized function code data and restart operation.
2 A strong noise was issued to the inverter while function code data was written (during initialization in particular).	Take noise suppression measures (grounding state, control/main circuit wiring and installation). Perform the check written for 1. → Take noise suppression measures. Restore the initialized function code data and restart operation.
3 Failure in control circuit	Perform H03 to initialize data and, after initialization is finished, press the PRG/RESET key to reset the alarm. → There is a problem in one of printed circuit boards including the CPU. Contact Fuji Electric.

13) Er2 Keypad communication error

Phenomenon An error was caused in communication between the keypad and inverter.

Cause	Check and remedy
1 Broken communication cable or poor contact	Check for continuity of the cable and contact faults in connections. → Securely insert connectors. → Replace the communication cable.
2 Strong noise issued to inverter	Check the noise suppression measures (grounding state, communication cable/main circuit wiring and installation). → Take noise suppression measures. For details, refer to "Appendix A" of "FRENIC-Multi User's Manual."
3 Failure of keypad	Use another keypad to check if Er2 is caused. → Replace the keypad.

14) Er3 CPU error

Phenomenon A CPU error (e.g. runaway) occurred.

Cause	Check and remedy
1 Strong noise caused to inverter	Check noise suppression measures (grounding state, signal and communication cable/main circuit wiring and installation method). → Improve noise suppression measures.

6.5.2 Diagnosis on the Motor Revolution Error

(1) The motor does not rotate.

Cause	Check and remedy
1 The main power is not supplied correctly.	Check the input voltage, output voltage, phase-to-phase imbalance and so on. → Install a molded circuit breaker, earth leakage breaker (with overcurrent protection function) or electromagnetic contactor. → Check the voltage drop, phase lack, poor contact, poor continuity and similar failures and take necessary measures.
2 No forward/reverse rotation command is supplied or both are supplied simultaneously (terminal block operation)	Use the keypad and select I/O Check from the menu to check the forward/reverse rotation command supply state. → Supply a run command. → Turn the forward/reverse command off. → Correct errors in FWD or REV terminal allocation. (E98, E99) → Correct the external circuit wiring of terminals FWD and REV. → Securely change the sink/source changeover switch provided on the printed circuit board.
3 No direction of rotation instruction (keypad operation)	Use the keypad and select I/O Check from the menu to check the forward/reverse rotation command supply state. → Supply a direction of rotation command (F02=0) or select keypad operation with a fixed direction of rotation (F02=2 or 3).
4 Because the keypad operates in the program mode, no operation command (keypad operation) is accepted from the keypad.	Check the keypad to check the current operation mode in which the inverter operates. → Start the operation mode before supplying an operation command.
5 An operation command having higher priority is valid and a stop command is issued.	While referring the operation command block diagram*, use the keypad and select function code data check and I/O check from the menu to check the operation command having priority. * (Refer to "Section 4" of "FRENIC-Multi User's Manual.) → Correct settings errors of function code data such as H30 and y98, or cancel operation commands having priority.
6 The frequency setting is smaller than the starting or stopping frequency.	Use the keypad and select I/O Check from the menu to check if the frequency is entered. → Change the frequency setting to equal to or larger than the starting frequency (F23) or stopping frequency (F25). → Examine and change (reduce) the starting frequency (F23) or stopping frequency (F25). → Inspect the frequency console, signal converter, switch or relay contacts and so on and replace broken parts. → Correctly connect external circuit wires of terminals 13, 12, 11 and C1.
7 A frequency command having higher priority is active.	Use the keypad and select function code data check and I/O check from the menu according to the block diagram* for entering the frequency to check. * (Refer to "Section 4" of "FRENIC-Multi User's Manual.") → Correct the function code data entry error (cancel the frequency setting with higher priority).
8 The upper or lower limit setting of the frequency limiter is excessive.	Check the data of function codes F15 (frequency limiter (upper limit)) and F16 (frequency limiter (lower limit)). → Change the settings of F15 and 16 to the correct ones.
9 The coast-to-stop command is effective.	Check the data of function codes E01, E02, E03, E04, E05, E98 and E99 and refer to the I/O check to check the input signal status. → Cancel the coast-to-stop command.
10 Broken wire, connection error or poor contact of motor	Check the wires. (Measure the output current.) → Repair or replace motor wires.
11 Excessive load	Measure the output current. → Reduce the load (The load may become excessive in winter).
	Check if the mechanical brake is applied. → Release the mechanical brake.

Cause	Check and remedy
12 Insufficient motor torque	Increase the torque boost settings (F09 and A05) and check if the motor starts. → Increase F09 and A05.
	Check the data of function codes F04, F05, H50 to H53, A02 and A03. → Change the V/f setting according to the motor.
	Check if motor changeover (selection between the first and second motors) is correct and if the settings match the corresponding motor characteristics. → Correct the motor changeover signal. → Enter function codes according to the motor to be used.
	Check if the frequency setting signal is equal to or smaller than the motor slip frequency. → Change the frequency signal setting to above the slip frequency of the motor.
13 Connection error or poor coontact of DC reactor (DCR)	Check wiring. → Connect the DC reactor. Repair or replace the DC reactor wires.

(2) The motor rotates, but the speed does not increase.

Cause	Check and remedy
1 The maximum frequency setting is too low.	Check the data of the maximum output frequency (F03 and A01) → Change F03 and A01 to the correct values.
2 The upper limit of the frequency limiter is too low.	Check the data of the frequency limiter (upper limit) (F15). → Change F15 to the correct value.
3 The frequency setting is too low.	Use the keypad and select I/O Check from the menu to check if the frequency setting signal is correctly supplied. → Increase the frequency setting. → Replace the frequency console, signal converter, switch, relay contact or the like if it is broken. → Connect external circuit wires to terminals 13, 12, 11, and C1.
4 Another frequency command (multistep frequency, communication, etc.) having higher priority is valid while the frequency setting is too low.	Use the keypad and select function code data check and I/O check from the menu according to the frequency setting block diagram* to check the supplied frequency command. * (Refer to "Section 4" of "FRENIC-Multi User's Manual.") → Correct the function code data entry error (cancel the frequency setting having higher priority, etc.).
5 The acceleration time is too long or too short.	Check the acceleration time data (F07 and E10). → Enter the acceleration time matching the load.
6 Excessive load	Measure the output current. → Reduce the load.
	Check if the mechanical brake is applied. → Release the mechanical brake. (Adjust the fan damper or pump valve.) (The load may be large in winter.)
7 Motor characteristics are different.	Check if P02, P03, P06, P07 and P08 (A16, A17, A20, A21 and A22) match the motor constants if automatic torque boost, automatic energy saving operation or the like is conducted. → Perform auto tuning.
8 The output frequency does not increase in the current limiting action.	Check if the current limit (mode selection) data (F43) is set at "2" and check the data of the current limit (level) (F44). → Change F44 to the adequate value or, if the current limit is unnecessary, change F43 to "0" (disabled).
	Reduce the torque boost amount (F09) and restart. Check if the speed increases. → Adjust F09.
	Check the data of function codes F04, F05, H50 to H53 to check if the V/f setting is correct. → Adjust the V/f setting to the motor rating.

Cause	Check and remedy
9 The output frequency does not increase in torque limiting operation.	Check if the data of the torque limit level (F40, F41, E16 and E17) is adequate. In addition, check if torque limit 2/1 changeover is correct. → Chang F40, F41, E16 and E17 to adequate values or cancel them. → Correct the torque limit 2/1 changeover signal.
10 Bias/gain setting error	Check the data of the function codes (F18, C50, C32, C34, C37, C39, C42 and C44). → Correct the bias and gain settings.

6.6 Emergency Stop Tripped by Area Sensor

6.6.1 When Area Sensor Cannot be Initialized

Before turning the power on, always check area sensor operation (for presence/absence of an obstacle).

If the power is turned on with the carrier of lifter is in a position to shut off the optical axis of the area sensor, presence of an obstacle on the optical axis of the area sensor is judged to turn off the power supply to the drive system.

To correct the situation, the maintenance staff invalidates the area sensor by using the key switch in the control box.

■ **To recover**

(1) When the machine is in interlocked operation and the loom was not moved while the power was OFF, execute the operation of the interlocked operation in the step operation step by step until doffing is completed. Upon completion of the doffing, return the key switch to validate the area sensor (see 4.1.14).

(2) When the case is other than (1) above:

1) The maintenance staff moves the carrier and the lifter to the origin by watching and avoiding collision.

2) Remove the bobbins on the fork to outside the FL and lifter or the working area of the doffer (between the lifter pillar and the FL). This work is carried on manually.

3) After checking that no bobbin remains on the fork, return it to the origin.

4) Return the key switch to validate the area sensor.

NOTE: If the machine fails to recover after making above steps, check the area sensor and the area sensor controller (see 6.6.2 Area Sensor Controller Error and 6.6.3 Area Sensor Error).

6.6.2 Area Sensor Controller Error

Check the content of error by the status of turning on and blinking of the LED indicator lamps of the area sensor controller (CR101) and take corrective actions accordingly.

- **LED indicator lamp**

Signal	Meaning
Signals of MM/XM	
PWR on	Supply voltage OK
M1-M4, I1, I2 on	Appropriate inputs are active (High)
I1, I2 blink alternately	A procedure error has occurred at inputs I1, I2
M1, M2 blink alternately	A procedure error has occurred at inputs M1, M2
M3, M4 blink alternately	A procedure error has occurred at inputs M3, M4
M1, M3 and M2, M4 blink alternately	Procedure error of both pairs (wrong direction, missing muting condition. Also possible; concurrence error between the sensors of both pairs)
M1 or M2 blinks	Concurrence monitoring error, the input that reaches the “good” state too late blinks
M3 or M4 blinks	Concurrence monitoring error, the input that reaches the “good” state too late blinks
EN, S1 on	Appropriate input is active (High)
S1 blinks	Time for operation of the reset button has expired (only for restart interlock)
Q1, Q2 on	Appropriate output is active (High)
OVR REQ blinks	System is in Override-required condition and is waiting for the restart button to be pressed
ERR off	There is no error condition

- **Error code**

Display	Possible cause	How to correct the fault
Fault displays of MM/XM/MDI		
●	Sequence error. Error is not at this module	Eliminate the error at the respective module
2 x ✹	Error in module configuration	Repeat the configuration procedure
3 x ✹	Rotary switch manipulated	Turn the rotary switch back to the original position Carry out a power-up or repeat teach-in
4 x ✹	Change to the configuration (at S1-S3 or rotery switches) with power off, or slot list comparison has found a difference	Reset configuration to original state, or re-connect module to original position, or carry out a power-up and repeat teach-in
5 x ✹	Supply voltage defective	Chech power supply
6 x ✹	Self-diagnostics, internal error, etc.	Carry out a power-up
7 x ✹	Maximum permissble number of override cycles exceeded	Check the muting arrangement and sensors

6.6.3 Area Sensor Error

In the case of defect, LED* indicators of the projector and the optical detector and the 7-segment display indicate the diagnostic information on the defect. The following table indicates the meaning of the indicator lamps, cause of defect, test and possible means of improvement of defects.

- **Projector**

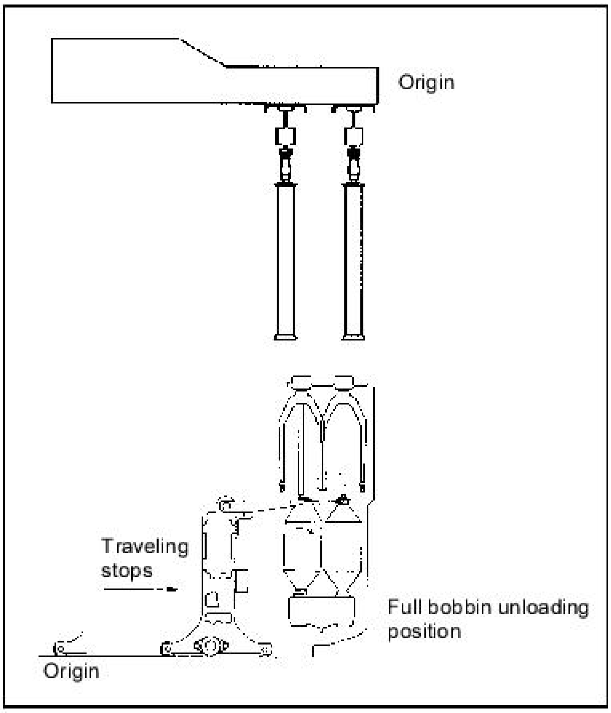
Indicator lamp	Meaning	Cause and test	Method of improvement
Yellow status LED of the projector does not light up.	No power is supplied to the unit.	Check the power supply.	Check the wiring and measure the voltage.
"E" is indicated on 7-segment display.	System defect	Faulty photoelectric switch	Replace the photoelectric switch.
"O" is indicated on 7-segment display.	External test	Test input open (OV)	Test with 24 V input.
"L" and "(1)" are indicated on 7-segment display.	Beam coding error	Check the wiring of the projector and optical detector.	Correct the wiring of the projector and the optical detector, turn the power OFF then ON again.

* For LED, see Section 5.1.3 "Area Sensor and Controller."

6.7 Corrective Action for Bobbin Delivery Error

6.7.1 Corrective Action for Deformed Bobbin Shoulder

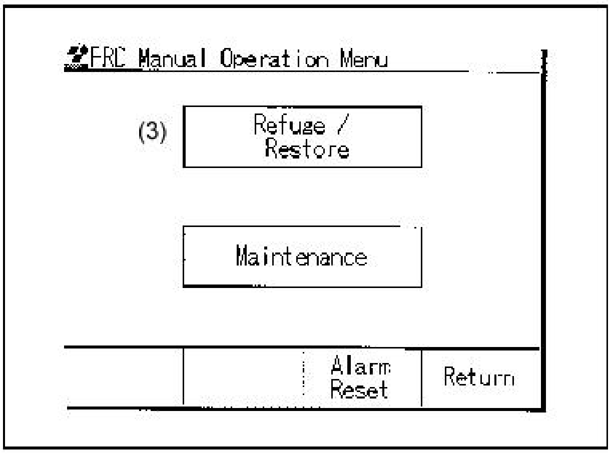
In the process the carrier travels to receive the full bobbin, the carrier stops when the optical axis from the deformed shoulder detect sensors (PH7 and PH8) installed to the FL is shielded. In this case, carry on the following actions to restart automatic operation:


Origin
Traveling stops
Full bobbin unloading position
Origin

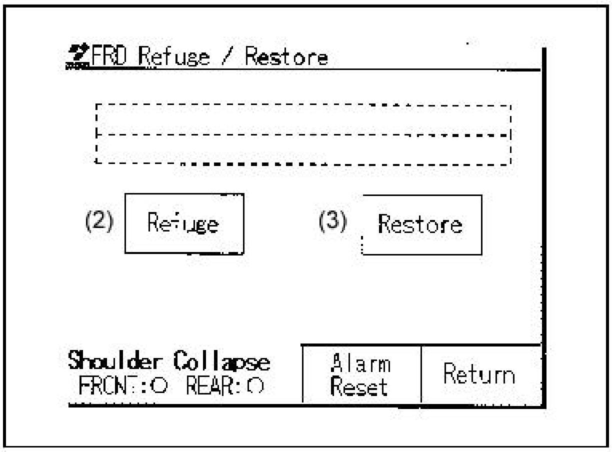
■ **Corrective action**

(1) Check the error message.

(2) Press alarm reset.

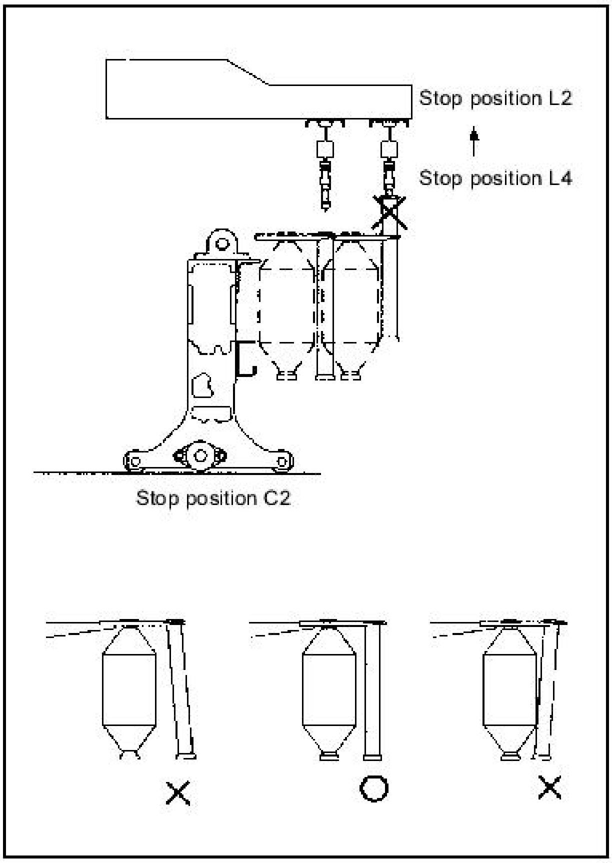

FRC Manual Operation Menu
(3)
Refuge / Restore
Maintenance
Alarm Reset
Return

(3) Switch to the manual operation mode and go to the Refuge/Restore screen (see 4.1.7).



FRD Refuge / Restore

Shoulder Collapse
FRONT:O REAR:O



(4) Press the Refuge key (2) to retract the carrier to the C3 position (see 4.1.8).

(5) Withdraw the bobbin with deformed shoulder from the FL.

NOTE: Check other spindles for possible generation of bobbins with deformed shoulder. Don't leave the bobbins withdrawn from the FL within the working range of FRD.

(6) Check safety around the machine and press FRD Restore key (3) to restart automatic operation.

⚠ CAUTION

> If the bobbin with a deformed shoulder is removed without moving the carrier, the fork may be bent. Always perform the Refuge/ Restore operation.

6.7.2 Corrective Action of Empty Bobbin Delivery Error to the Fork

After switching the hanger, when the empty bobbin delivery error detect sensors (PH1 and PH2) installed on the safety door detect a delivery error while the lifter is in rising process, FRD automatically stops. In this case, automatic operation can be restarted by carrying on the following actions:

■ **Corrective actions**

(1) Check the error message.

(2) Depress the emergency stop button of the FRD.

(3) Remove the empty bobbins from the hangers from behind the carrier.

CHECK: See if the hanger can be switched normally. If any abnormality is detected in switching the hanger, replace the hanger.

(4) Place empty bobbin on the fork.

(5) Ensure safety around the machine and reset the FRD emergency stop button.

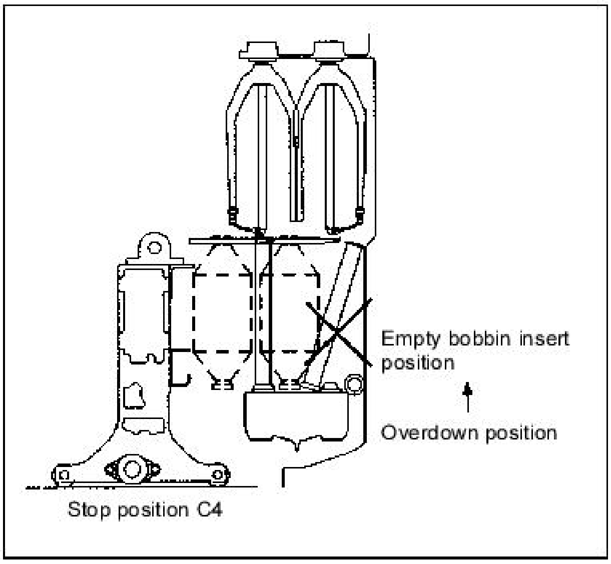
(6) Reset the FRD alarm, depress the automatic operation start button to restart operation. (See 4.1.6)

6.7.3 Corrective Action for Empty Bobbin Delivery Error to the FL

Actions for a delivery error of empty bobbin to the FL differ depending on the state of bobbin that failed to be delivered properly.

The delivery error of empty bobbin to the **FL** is detected by the inclination detect sensors (PH206 and PH207) installed to the FL.

[1] If the Empty Bobbin is not Inserted to the Bobbin Wheel:



When the bobbin rail rises to the empty bobbin insert position from the overdown position, the empty bobbin falls down on the bobbin rail unless it is inserted to the bobbin wheel. The inclination detect sensors detect the falling, and after the bobbin rail rises to the empty bobbin insert position, automatic operation stops.

Automatic operation restarts when the following actions are taken:

REFERENCE: An error message reading “E-84 FRD bobbin fallen” is indicated on the panel of the FL. No error message is indicated on the FRD panel.

(1) Check the error message on the FL panel.

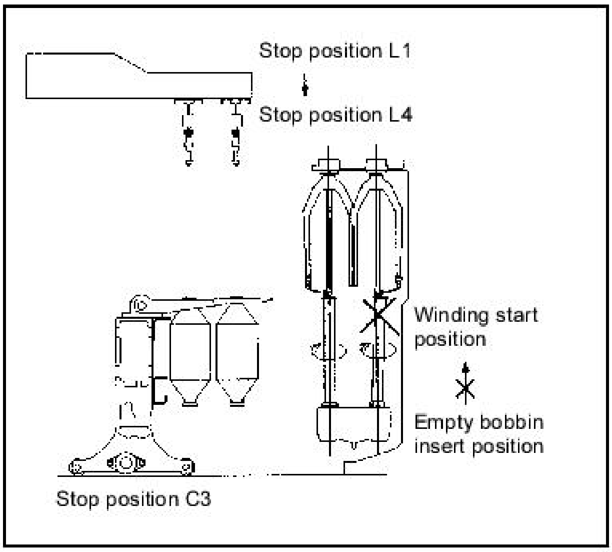
(2) Wait until the FRD completes doffing.

(3) Insert any empty bobbin fallen or tilted on the bobbin rail into the bobbin wheel.

NOTES:

- Check that the bobbin wheel is free of fluff and other wastes.
- Check that the wheel cap is in place properly.
- Check the empty bobbin for any damage under its collar or at its bottom.
- Check other bobbins and see if delivery error has occurred to them.

(4) Reset alarm on the FL panel, and depress the rail up button to resume operation.



[2] When Empty Bobbin is Inserted to the Bobbin Wheel in Tilted State

- After the carrier reverses, the bobbin is checked at the empty bobbin insert position on the bobbin rail if it is inserted to the bobbin wheel in tilted condition. If so detected, the bobbin rail does not rise, and the FL does not make spinning operation.
- The FL panel displays an error message reading "E-65 Bobbin Insert Error." No error message appears on the FRD panel, however.
- Upon completing the FRD operation, spinning operation can restart by taking the following actions:

■ Corrective actions

Always take action for the empty bobbin that failed proper delivery after the FRD automatic operation is completed (when the lifter, carrier and the fork are at their origin).

(1) Check the error message on the FL panel.

(2) Insert the tilted empty bobbin to the bobbin wheel correctly.

CHECK 1: Check that the bobbin wheel is free of fluff, other fiber wastes, etc.

CHECK 2: Check if the wheel cap is out of place.

CHECK 3: Check if the empty bobbin has damages on the bottom.

NOTE: Check if other spindles have the similar bobbin insert error.

(3) Reset alarm on the FL panel, depress the doffing switch to restart the spinning operation. (See 4.2.1)

[3] If an Empty Bobbin is Fallen on the Bobbin Rail.

- If an empty bobbin is fallen on the bobbin rail due to a failure in detecting an empty bobbin insertion error, it is detected while the bobbin rail is raised to the winding start position to avoid spinning operation in that state.
- Error message "E-84 fallen FRD bobbin" is displayed on the FL panel. No error message appears on the FRD panel.

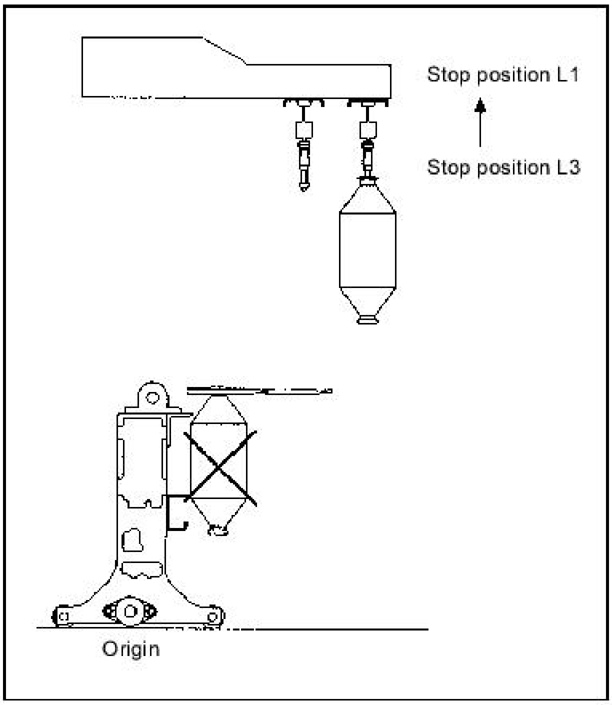
■ Corrective action

Always handle the empty bobbin after the end of automatic FRD operation.

(1) Check the error message on the FL panel.

(2) Remove the fallen empty bobbin.
For spinning without adding the bobbin to the unloaded spindle, remove the sliver and roving for the spindle, reset the alarm on the FL panel and restart the spinning operation.

When adding the bobbin at the unloaded spindle, reset the alarm, set the mode select switch on the operation panel to manual, lower the bobbin rail to the full bobbin unloading position, and insert the empty bobbin. When raising the bobbin rail again after empty bobbin insertion, carefully check to see there is no tilted bobbin.



6.7.4 Corrective Action for Full Bobbin Delivery Error to the Lifter

If full bobbin remains undelivered on the fork due to the hanger switching error, the full bobbin delivery error detect sensors (PH3 and PH4) installed to the safety door stop the lifter at L1.

(1) Check the error message.

(2) Depress the emergency stop button on the FRD.

(3) Withdraw the full bobbin left on the fork from behind the carrier and hang on to a hanger.

NOTES:

- Check if the hanger can be switched normally.
- If any abnormality is detected in switching the hanger, replace the hanger.
- Check if the similar delivery error has occurred to other spindles.

(4) Check the safety around the loom and reset the FRD emergency stop button.

(5) Reset alarm on the FRD and depress the automatic operation start button to restart operation. (See 4.1.6)

6.8 Corrective Action for Stop Due to Any Trouble during Automatic Doffing

- If stopped by an error allowing automatic operation restarting, restart doffing by automatic restarting operation (see 5.3.1).
- If stopped by an error not allowing automatic operation restarting, return all units (carrier, lifter and fork) to their origins by position shifting operation (see 4.1.10). Perform manual doffing as required.

REFERENCE: The calling signal is set to OFF normally during FL operation (see 5.3.15). There are ranges (steps 16 to 20) during full automatic operation where FRD performs doffing though FL is operated. If the FRD stops in these ranges, each unit (carrier, lifter or fork) can be returned to its origin even if the calling signal is stopped.

M. LUBRICATION, MAINTENANCE, AND INSPECTION

M.1 Periodical Maintenance

M.1.1 Lubrication Points and Intervals

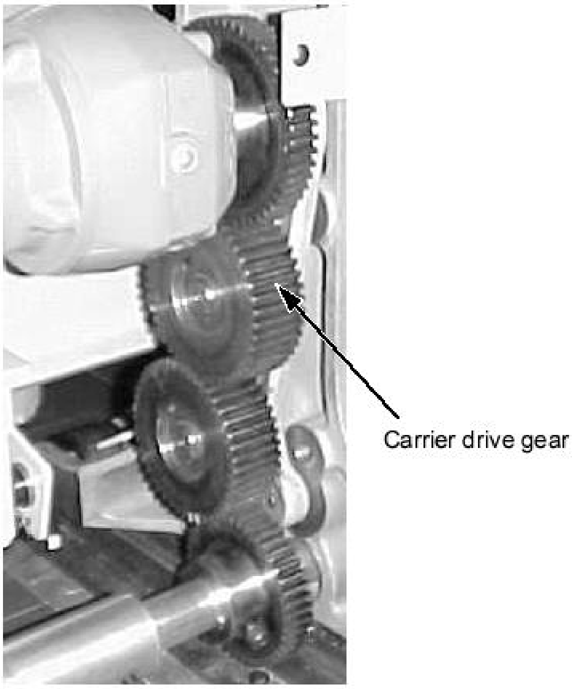
REFERENCE: For lubricant types, refer to the FL200 INSTRUCTION MANUAL, Section M.1, Subsection M.1.2.

[1] Every 3 Months (or 12 Weeks)

(1) Carrier drive gears

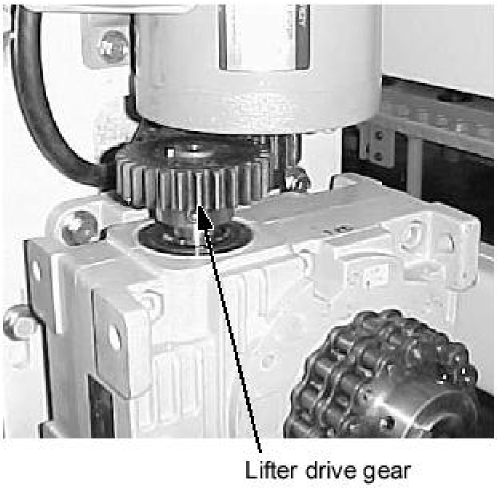
Lubrication tools:	Brush
Lubricant:	Lubricant D

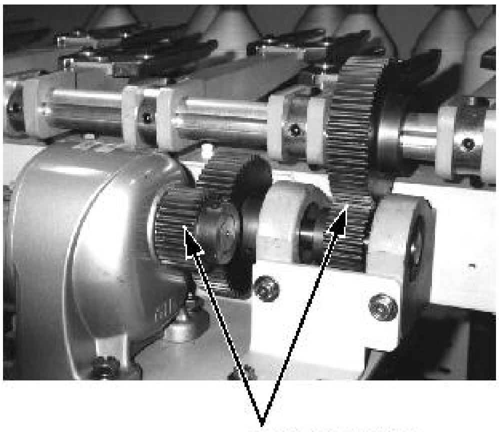
NOTE: Limit the lubricant amount to the irreducible minimum, which prevents fly or fleece from accumulating on the carrier drive gears.



(2) Lifter drive gears

Lubrication tools:	Brush
Lubricant:	Lubricant D

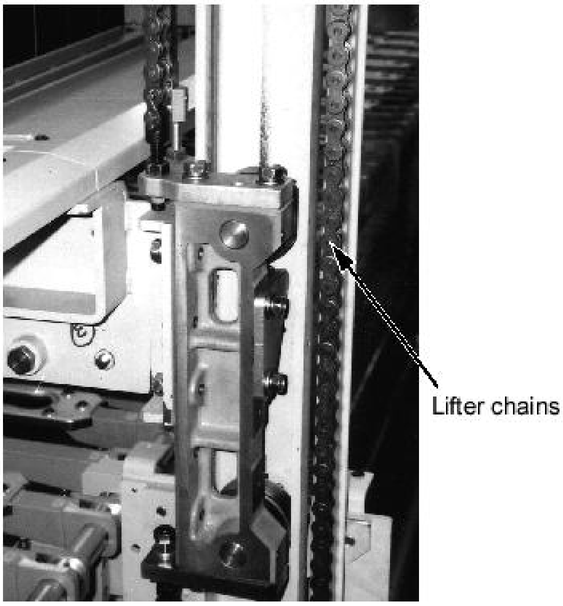



Fork drive gear

(3) Fork drive gears

Lubrication tools:	Brush
Lubricant:	Lubricant D

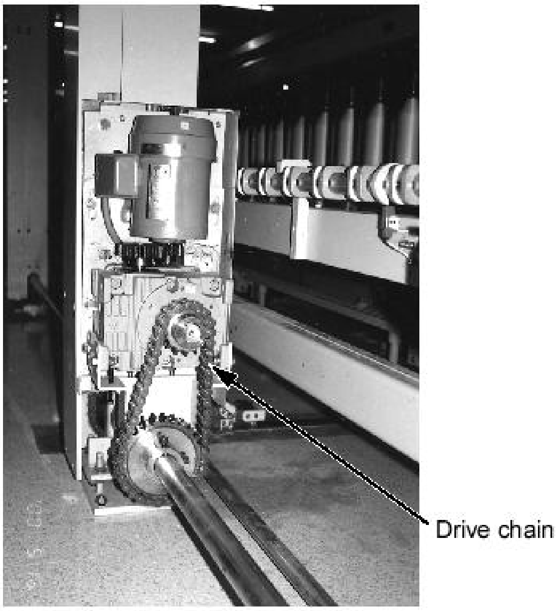
[2] Every 6 Months (or 24 Weeks)



(1) Lifter chains

Lubrication tools:	Oiler, funnel, and drain container
Lubricant:	Lubricant G

CHECK: Chain tension (Refer to Subsection 2.3.9.)



(2) Drive chains

Lubrication tools:	Oiler, funnel, and drain container
Lubricant:	Lubricant G

CHECK:

- Chain tension (Refer to Subsect. 2.3.13.)
- Gap between the tension brackets and lifter shafts (Refer to Subsect. 2.3.17.)

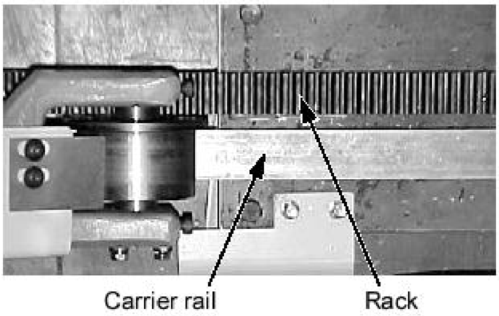
M.1.2 Cleaning and Inspection

To get the most out of the capabilities built in the FRD, maintain high quality roving, and extend machine life, the maintenance work given in this section should be performed properly and carefully.

The maintenance (cleaning and inspection) intervals will vary depending upon the type of fibers used, roving weight produced, spinning facilities of your plant, and other conditions. This section gives you the typical maintenance intervals and procedures.

After completion of maintenance work, be sure to have the maintenance supervisor inspect the job.

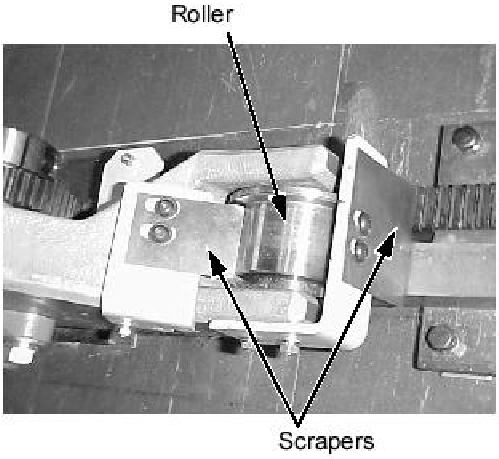
[1] Every 0.25 Months (Weekly)



(1) Carrier rails & racks and their surroundings

Tools: Hand picker or brush

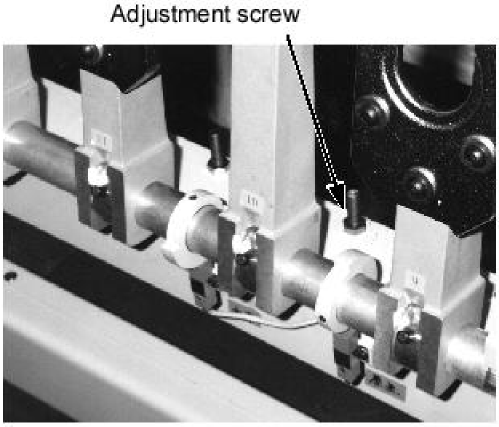
- Remove fly or fleece from carrier rails & racks and their surroundings.
- Clean the floor.



(2) Scrapers

Tools: Hand picker or brush

- Remove fly, fleece, and foreign materials from scrapers, rollers, and their surroundings.



(3) Adjustment screws on fork arms

Tools: Hand picker or brush

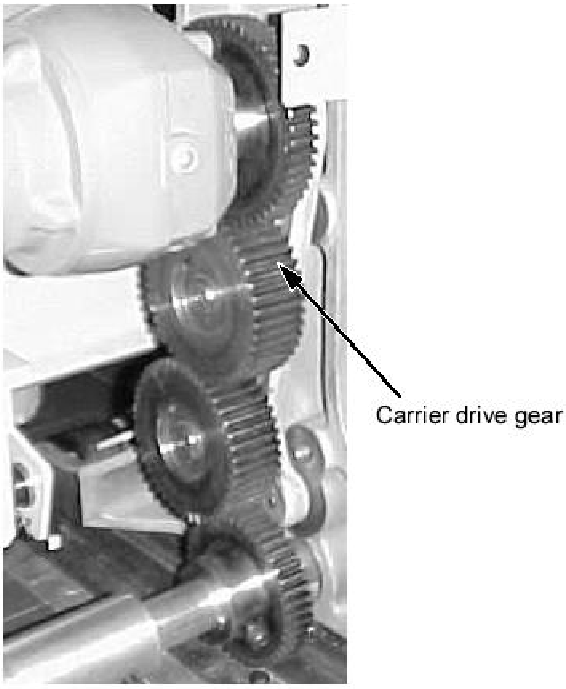
- Remove fly and fleece from adjustment screws, angle brackets, and their surroundings.

[2] Monthly (or Every 4 Weeks)

(1) Carrier drive gears

Tools: Hand picker or brush

- Take off the drive cover and remove fly or fleece.

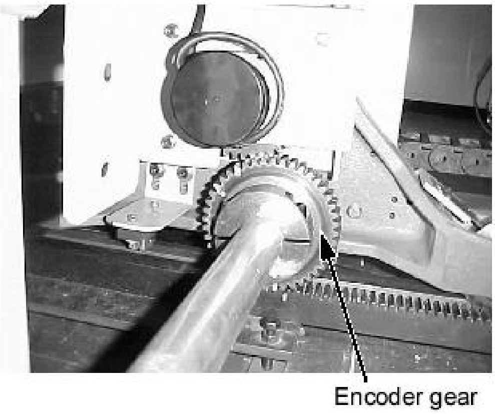

Carrier drive gear

(2) Encoder gears and their surroundings

Tools: Hand picker or brush

- Remove fly or fleece.

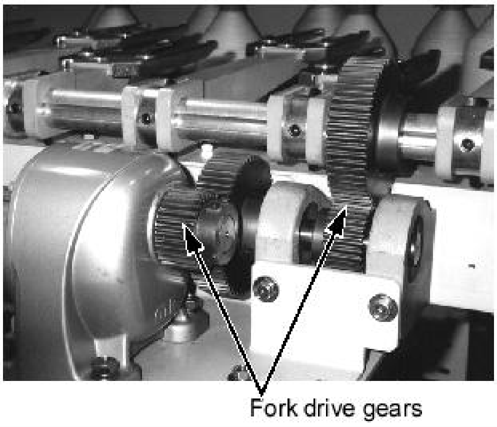
CHECK: The backlash (refer to Subsect. 2.2.7).


Encoder gear

(3) Fork drive gears

Tools: Hand picker or brush

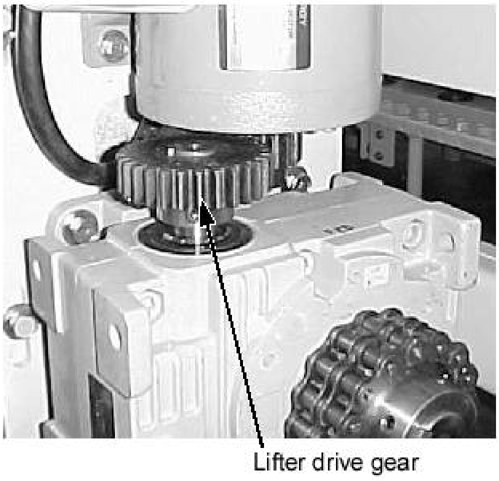
- Take off fork front covers and fork rear covers, then remove fly or fleece.


Fork drive gears

(4) Lifter drive gears

Tools: Hand picker or brush

- Take off lifter drive covers, then remove fly or fleece.

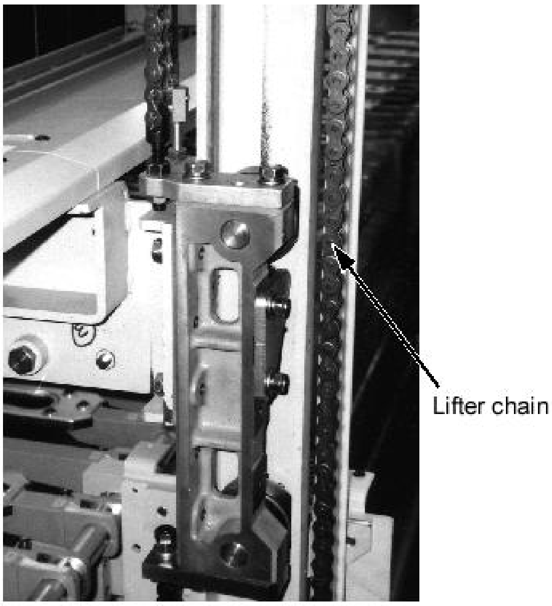

Lifter drive gear

[3] Every 3 Months (or 12 Weeks)

(1) Lifter chains

Tools: Hand picker or brush

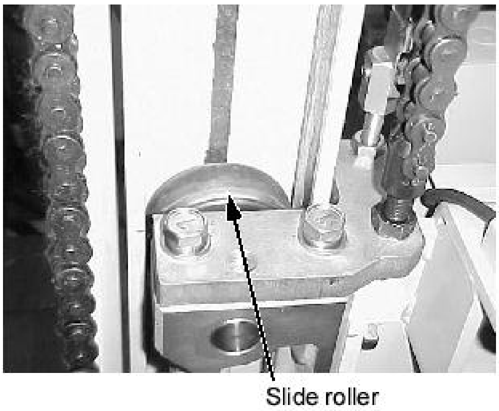
- Take off the lifter covers and remove fly or fleece.

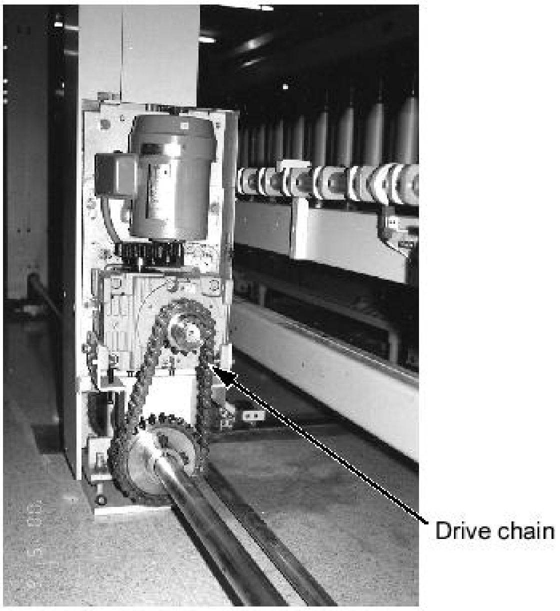

Lifter chain

(2) Slide rollers

Tools: Hand picker or brush

- Take off the lifter covers and remove fly or fleece accumulating between slide rollers and pillars.

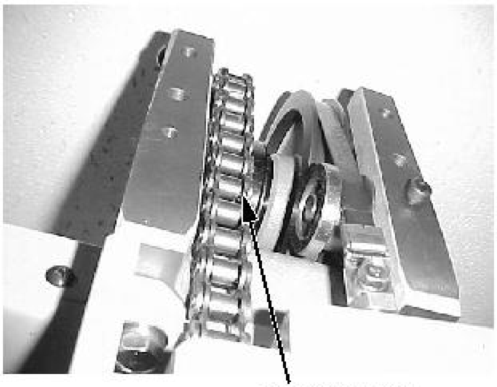

Slide roller


Drive chain

(3) Drive chains

Tools: Hand picker or brush

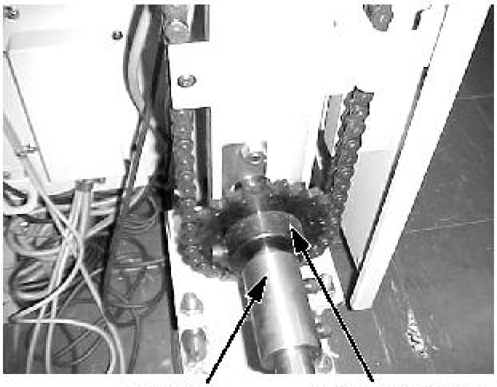
- Take off the drive covers and remove fly or fleece.


Sprockets (top)

(4) Sprockets (top)

Tools: Hand picker or brush

- Take off the top cover and remove fly or fleece.


Coupling
Sprockets (bottom)

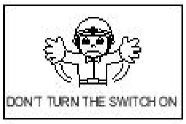
(5) Sprockets (bottom)

Tools: Hand picker or brush

- Take off the bottom cover and remove fly or fleece from sprockets, couplings, and their surroundings.

M.2 Periodical Maintenance Relating to Instrumentation

Perform the maintenance for the electrical components and electronic devices as listed below, at the specified periodical maintenance intervals.


DON'T TURN THE SWITCH ON

⚠ WARNING

During the maintenance work, be sure to observe the precautions given in
FL200 INSTRUCTION MANUAL Section S.1,
S.1.3, "Rules for Maintenance Work"
S.1.4, "Rules for Handling and Inspecting Electrical Units."

M.2.1 General Maintenance

Item	Maintenance job	Intervals
1. Cleaning	Clear fly or fleece with a vacuum cleaner from the following: • Inside the control box • Cooling fan cover of each motor	Every 3 months
2. Inverters	• Maintain inverters, referring to "Subsect. M.2.2 Maintenance & Inspection of Inverters."	Daily and every 3 months
3. Looseness of terminals	• Visually check that the terminal boards of the power circuitry are not discolored partially due to heat generated by looseness of screws. • Check with a screwdriver that the screws on the terminal pins are not loose.	Yearly
4. Sequencer	• Maintain the sequencer, referring to "Subsect. M.2.3 Maintenance & Inspection of Sequencers."	Every 3 months

M.2.2 Maintenance & Inspection of Inverters

⚠ WARNING

- Before starting the maintenance and inspection procedure, turn off the main circuit breaker and wait at least 5 minutes, and then check:
  - that the CHARGE lamp is off and
  - that the DC voltage between pins P and N. It should be less than 25 V.

  An electrical shock could result.
- The authorized persons only should be allowed to carry out maintenance/inspection and replace parts.
- Take off watches, bracelets, and any other metal objects. Use insulated tools.
- Never modify inverters.
  An electrical shock or bodily injury could result.

Perform daily inspection and periodical inspection to prevent failures and keep highly reliable operation for a long period.

[1] Daily Inspection

When the inverter is in operation and on standby (with the power being on), visually check that the inverter operates normally, without removing the covers.

Usually the following items should be checked:

(1) Getting the expected performance (satisfying the required specifications) from the inverter?

(2) Environmental conditions satisfy the required specifications?

(3) No problem with the touch panel display?

(4) No abnormal noise, vibration, or odor?

(5) No discoloration due to heat?

[2] Periodical Inspection

Before starting the inspection job, stop the inverter operation, shut down the power, and remove the covers.

After the inverter power is shut down, it will take time to discharge smoothing capacitors used in the DC section of the main circuit. Charged capacitors are DANGEROUS. After the CHARGE lamp goes off, be sure to check with a circuit tester that the DC voltage has dropped to the safe level (25 VDC or below) before starting the job.

For periodical inspection items and procedures, refer to “[2.1] Periodical Inspection List” given on the next page.

[2.1] Periodical Inspection List

Check where:		Check:	How to check or what to do:	Requirements
Environmental conditions		1 Ambient temperature, humidity, and environments (whether there are dust, dirt, gases, oil mist, and dew condensation).	1 Visual check and measurement with measuring instruments	1 They should satisfy the standard specifications. - Ambient temperature: −10 to +50°C - Relative humidity: 20 to 90% - No dew condensation - No abnormality
		2 Around the inverter (whether tools, dangerous articles, and other foreign materials are left down).	2 Visual check	2 Surroundings should be free of those materials.
Source voltage		Voltage levels of the main circuitry and control circuitry	Measurement with a circuit tester	200 to 230 VAC, 50/60 Hz
Touch panel		1 Panel display for legibility 2 Characters for missing	1 and 2 Visual check	1 and 2 Easy-to-read panel display and no defective
Frames, covers, and structure		1 For any abnormal noise or vibration	1 Visual check and auditory check	1 to 5 No abnormality
		2 Bolts for looseness	2 Tighten bolts further.	
		3 For any deformation or breaks 4 For discoloration due to overheat 5 For any stain, or dust or dirt accumulating	3 to 5 Visual check	
Main circuitry	Circuit overall	1 Bolts for looseness or slipping out	1 Tighten bolts further.	1 to 3 No abnormality
		2 Devices and insulators for any cracks, breaks, deformation, or discoloration (due to overheat or deterioration) 3 For any stain, or dust or dirt accumulating	2 and 3 Visual check	
	Conductors and cables	1 Conductors for any discoloration or warp due to overheat 2 Sheath of cables for breaks, cracks, or discoloration	1 and 2 Visual check	1 and 2 No abnormality
	Terminal boards	For damages	Visual check	No abnormality
	Smoothing capacitors	1 For leakage of liquid, discoloration, cracks, or expansion 2 Safety valves (whether some valves are popped off or expanded)	1 and 2 Visual check	1 and 2 No abnormality
		3 Capacitance if necessary	3 Measurement with a capacitance level instrument [*1]	3 Capacitance ≥ Rated value × 0.8
	Resistors	1 For abnormal odor or cracks in insulating materials due to overheat	1 Olfactory check and visual check	1 No abnormality
		2 For disconnection	2 Visual check or measurement with a circuit tester (after disconnecting either one of resistor leads)	2 Within "rated resistance ±10%"
	Transformers and reactors	For any abnormal beat or abnormal odor	Auditory check, visual check, and olfactory check	No abnormality
	Electro-magnetic contactors and relays	1 For chattering noise during operation 2 For roughness on contactors	1 Auditory check 2 Visual check	1 and 2 No abnormality
Control circuitry	Control PCBs and connectors	1 Screws and connectors for looseness	1 Tighten them further.	1 to 4 No abnormality
		2 For any abnormal odor and discoloration	2 Olfactory check and visual check	
		3 For any cracks, breaks, deformation, or remarkable rust 4 Capacitors for leakage of liquid or deformed marks	3 and 4 Visual check	
Cooling system	Cooling fans	1 For any abnormal noise or vibration	1 Auditory check and visual check. Check by rotating fans by hand after turning the power off.	1 Smooth rotation
		2 Bolts for looseness	2 Tighten bolts further.	2 and 3 No abnormality
		3 For discoloration due to overheat	3 Visual check	
	Vents	Cooling fans and intake & exhaust vents for clogging or accumulation of foreign materials	Visual check	No abnormality

[*1] Use easy-to-handle capacitance level instruments that are commercially available recently.

If inverters are stained, wipe stains off with a chemically neutral cloth. Remove dust with a vacuum cleaner. The cleaning job should be done after the power is turned off in the same way as for the periodical inspection (see the previous page).

[2.2] Parts Replacement

Service lives of parts used in inverters are determined but will be affected according to the ambient environments or service conditions. It is recommended that those parts be replaced at intervals listed in the table below.

■ Parts Replacement Interval Guide

Parts name	Typical replacement intervals	Remarks
Cooling fan	10 years	Replace with a new one.
Smoothing capacitor	10 years	Replace with a new one. (For details, determine after inspection.)
Aluminum electrolytic capacitor on PCB	10 years	Replace with a new one. (For details, determine after inspection.)
Other parts	—	Determine after inspection.

M.2.3 Maintenance & Inspection of Sequencers

[1] Check Items

Check the sequencer (MICREX-F) according to the table below.

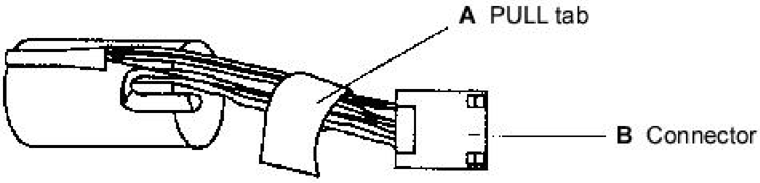
Check items		Check the following:	Requirements	How to check:
Processor ALARM lamp		Check the on/off state of the ALARM lamp.	Should be off.	Visual check
Power supply of the base unit	• Voltage	Is the voltage level on the terminal board within the specified range?	VAC: –15 to +10% 100 V: 85 V to 132 V 200 V: 170 V to 264 V VDC: –15 to +20% 24 V: 19 V to 30 V 110 V: 90 V to 140 V	Circuit tester
	• Voltage regulation	Does instantaneous power failure happen frequently or does the voltage level change rapidly?	The voltage regulation should be within the above range.	Oscilloscope
Power supply of I/O capsule	• Voltage	Is the voltage level on the terminal board within the specified range?	VAC: –15 to +10% 100 V: 85 V to 132 V 200 V: 170 V to 264 V VDC: –15 to +10% 24 V: 19 V to 30 V 110 V: 90 V to 140 V	Circuit tester
	• Voltage regulation	Does instantaneous power failure happen frequently or does the voltage level change rapidly?	The voltage regulation should be within the above range.	Oscilloscope
Ambient environments	• Temperature	Is the ambient temperature within the specified range? (For the sequencer installed in the panel, is the temperature inside the panel within the specified range?)	0°C to +55°C	Max. and min. thermometers
	• Humidity	Any dew condensation, remarkable discoloration, or rust?	20% to 90% RH	Visual check and hygrometer
	• Vibration	Any vibration?	No vibration	Tactual check
	• Dust or dirt	Any dust, dirt, or foreign materials accumulating?	None	Visual check
Installation state		Cards secured?	No looseness	Visual check
		Terminals of external wires secured with screws?	No looseness	Screwdriver
		Connectors of connection cables plugged in firmly?	No looseness or play	Visual check and use of screwdriver
		External wires damaged or broken?	No defects on the external appearance	Visual check
Battery		Replacement time?	Indication on the battery service life label	Battery replacement procedure (See given on the next page.)
Spare parts		Specified quantities ready to use and stored in a good condition?	Record on the check list	
Programs		No errors after checking?	No errors	Program check

- If the sequencer fails, replace a defective card(s). It is recommended that at least the minimum number of spare cards be ready for use.
- The battery will self-discharge and the voltage level will decrease even if it is left without use. Before the replacement time, replace it with a new one.

[2] Sequencer Battery Replacement

If the battery life printed on the label expires, replace the battery with a new one even if no battery alarm message appears. (This is because you may miss the alarm message. After the alarm message displays, the battery may backup the sequencer for approx. one week of power failure.)

- Replacement time: Guaranteed replacement period printed on the label
  (Date after 5 years from production, provided that the battery will be used at the ambient temperature of 25°C)
- Battery type: NL8V-BT (FBT030A)



A PULL tab:
To remove the battery from the base unit, pull out this tab gently. On this tab is the guaranteed battery life printed.
B Connector:
Connects the battery with the base unit.

- Nominal voltage: 3.6 VDC

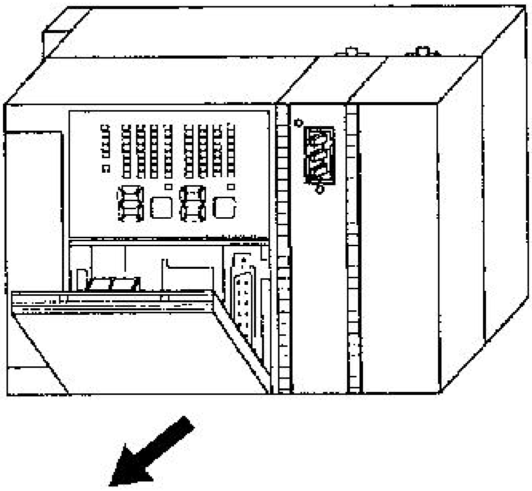
■ Battery handling notes

- Do not short-circuit both polarities with each other.
- Do not put batteries into fire.
- Do not recharge batteries.
- Do not disassemble batteries.

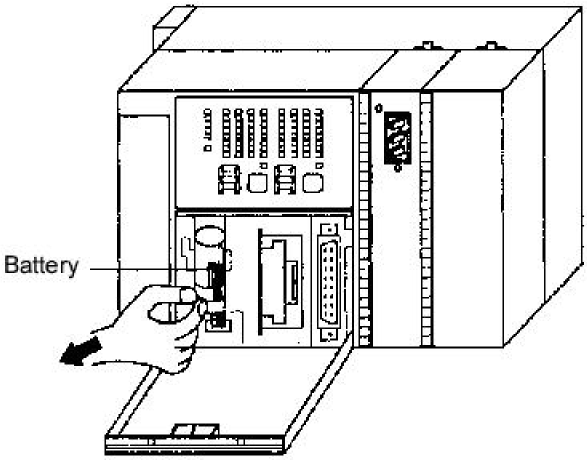
■ Battery replacement procedure

(1) Turn the processor power off. (Battery replacement is possible with the power being on.)

(2) Open the cover.



(3) Remove the battery by pulling out the PULL tab.



(4) Disconnect the connector from the base unit.

NOTE: Replace the battery quickly. Load a new battery within 5 minutes after the removal in order to avoid data loss in user programs.

(5) Check the insertion direction of the connector of a new battery and connect it to the base unit.

(6) Push the battery into the base unit with your fingers.

(7) Close the cover.

(8) Turn the processor power on.

G. TOOLS & GAUGES

G.1 Tools & Gauges List

In the tools & gauges list given below, the degree of necessity is indicated by one of three letters--E, R, and C:

- E: Those tools and gauges are ESSENTIAL to the installation/maintenance work.
- R: It is RECOMMENDED that those tools and gauges be ready for use in the installation/maintenance work.
- C: Those tools and gauges are CONVENIENT if they are ready.

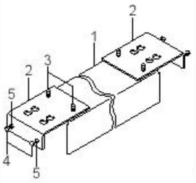
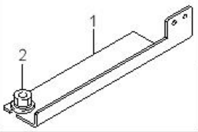
Illustration	No.	Parts Number	Parts Name	For 1 to 6 units							For more than 6 units							Degree of Necessity	Remarks
				520ST				440ST			520ST				440ST				
				140	120	108	96	120	108	96	140	120	108	96	120	108	96		
	1	F7801-10010-00	TOOL, CARRIER FRAME SET1	1	1	1	1	—	—	—	1	1	1	1	—	—	—	E	For positioning in the frame's longitudinal direction
		F7801-10020-00	TOOL, CARRIER FRAME SET1	—	—	—	—	1	1	1	—	—	—	—	1	1	1	E	For positioning in the frame's longitudinal direction
		F7801-10030-00	TOOL, CARRIER FRAME SET1	—	—	1	—	—	—	—	—	—	1	—	—	—	—	E	For positioning in the frame's longitudinal direction
		F7801-10040-00	TOOL, CARRIER FRAME SET1	—	—	—	—	1	1	1	—	—	—	—	1	1	1	E	For positioning in the frame's longitudinal direction
		F7801-10050-00	TOOL, CARRIER FRAME SET1	—	1	—	—	—	—	—	—	1	—	—	—	—	—	E	For positioning in the frame's longitudinal direction
		F7801-10060-00	TOOL, CARRIER FRAME SET1	—	—	—	—	—	1	1	—	—	—	—	—	1	1	E	For positioning in the frame's longitudinal direction
		F7801-10070-00	TOOL, CARRIER FRAME SET1	1	—	—	—	—	—	—	1	—	—	—	—	—	—	E	For positioning in the frame's longitudinal direction
	2	F7801-11010-00	TOOL-COMPL, CARRIER FRAME SET2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	E	Set up on F7801-100*0
	3	81304-08020	BOLT, HEXAGON 7T W/ WASHER TYPE6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	E	Set up on F7801-100*0
	4	81201-08040	BOLT, HEXAGON 4T	4	4	4	4	4	4	4	4	4	4	4	4	4	4	E	Set up on F7801-100*0
	5	84102-00800	NUT, HEXAGON 4T/PLATING	4	4	4	4	4	4	4	4	4	4	4	4	4	4	E	Set up on F7801-100*0
	1	F7801-18010-00	TOOL, CARRIER FRAME FIX	10	9	8	7	8	8	7	10	9	8	7	8	8	7	E	For positioning in the frame's front-to-rear direction
	2	81304-08020	BOLT, HEXAGON 7T W/ WASHER TYPE6	10	9	8	7	8	8	7	10	9	8	7	8	8	7	E	Used for F7801-18010-00

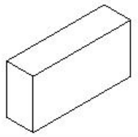
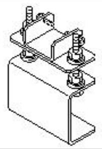
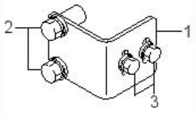
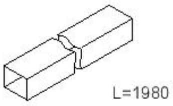
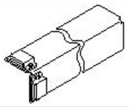
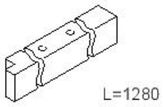
Illustration	No.	Parts Number	Parts Name	For 1 to 6 units							For more than 6 units							Degree of Necessity	Remarks
				520ST				440ST			520ST				440ST				
				140	120	108	96	120	108	96	140	120	108	96	120	108	96		
	1	F7801-19010-00	TOOL, CARRIER SHAFT SET	2	2	2	2	2	2	2	2	2	2	2	2	2	2	E	For centering carrier shafts
	1	F7801-21010-00	BRACKET-ASSY, LIFTER SHAFT	2	2	2	2	2	2	2	4	4	4	4	4	4	4	E	For centering lifter shafts
	1	F7801-27010-00	TOOL-COMPL, SLIDE SET	3	3	3	3	3	3	3	6	6	6	6	6	6	6	E	For securing slides
	2	81303-10060	BOLT, HEXAGON 7T W/ WASHER TYPE2	6	6	6	6	6	6	6	12	12	12	12	12	12	12	E	Used for F7801-27010-00
	3	81304-08020	BOLT, HEXAGON 7T W/ WASHER TYPE6	6	6	6	6	6	6	6	12	12	12	12	12	12	12	E	Used for F7801-27010-00
	1	F7801-31010-00	TOOL, FORK LEVEL SET	1	1	1	1	1	1	1	2	2	2	2	2	2	2	E	For positioning forks vertically
	1	F7801-34010-00	TOOL-ASSY, FORK HEIGHT SET	1	1	1	1	1	1	1	2	2	2	2	2	2	2	E	For positioning forks vertically
	1	F7801-50010-00	TOOL, FLOOR RAIL SET	1	1	1	1	1	1	1	2	2	2	2	2	2	2	E	For positioning carrier rails vertically

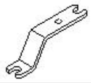
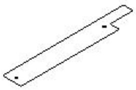
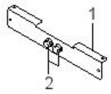
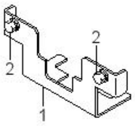
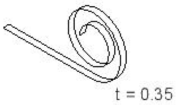
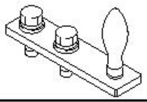
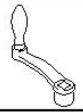
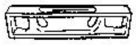
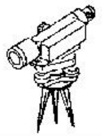
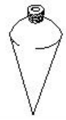
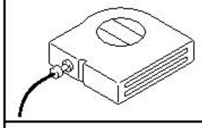
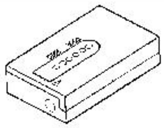
Illustration	No.	Parts Number	Parts Name	For 1 to 6 units							For more than 6 units							Degree of Necessity	Remarks
				520ST				440ST			520ST				440ST				
				140	120	108	96	120	108	96	140	120	108	96	120	108	96		
	1	F7801-55010-00	TOOL, SPECIAL SPANA 13	2	2	2	2	2	2	2	4	4	4	4	4	4	4	E	For installing rail bases
	1	F7801-57010-00	TOOL, SENSOR SET	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	For detecting bobbin shoulder collapse
	1	F7801-61010-00	TOOL, PILLAR SET	1	1	1	1	1	1	1	2	2	2	2	2	2	2	E	For installing lifter pillars
	2	81304-08020	BOLT, HEXAGON 7T W/ WASHER TYPE6	2	2	2	2	2	2	2	4	4	4	4	4	4	4	E	Used for F7801-61010-00
	1	F7801-65010-00	TOOL, HOUSING SET	1	1	1	1	1	1	1	2	2	2	2	2	2	2	E	For installing top housings
	2	81303-06012	BOLT, HEXAGON 7T W/ WASHER TYPE2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	E	Used for F7801-65010-00
	1	F7801-66010-00	TOOL, SHIM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	For positioning side rollers
	1	F7801-69010-00	LEVER-ASSY, CARRIER DRIVE HANDLE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	Handle for carriers
	1	76324-00004	HANDLE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	Handle for lifters

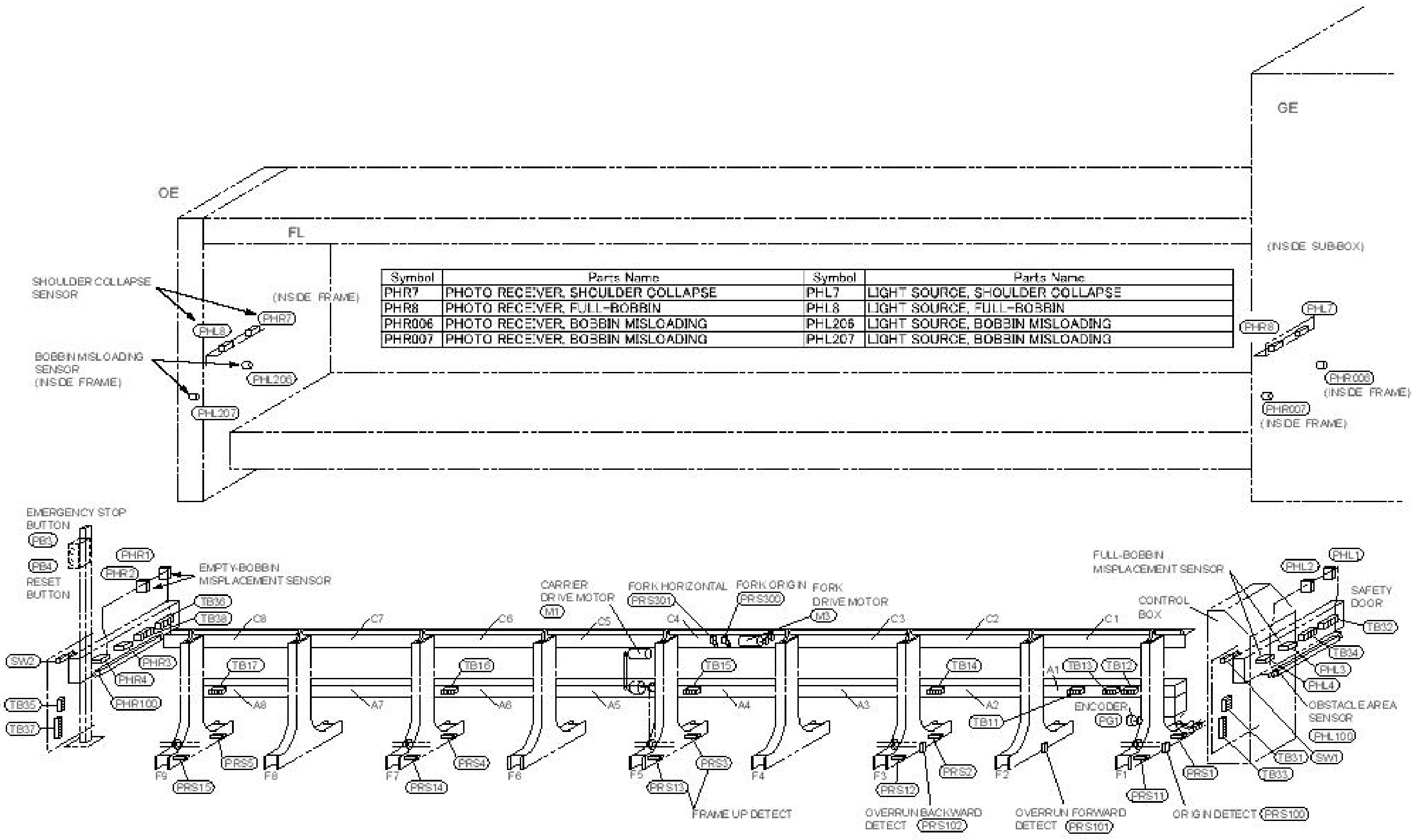
Illustration	No.	Parts Number	Parts Name	For 1 to 6 units							For more than 6 units							Degree of Necessity	Remarks
				520ST				440ST			520ST				440ST				
				140	120	108	96	120	108	96	140	120	108	96	120	108	96		
 150 mm	1	77133-00007	LEVEL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	Level
	1	77133-00011	LEVEL, TILTING	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	Transit
	1	77133-00012	TOOL, PLUMB BOB	4	4	4	4	4	4	4	4	4	4	4	4	4	4	E	Plumb bob
	1	77133-00013	MAGNET, TWINE	2	2	2	2	2	2	2	2	2	2	2	2	2	2	E	Magnet for plumb bob
	1	67190-00000	SENSOR, BEAM CHECKER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	For adjustment of the bobbin shoulder collapse sensor.

A. APPENDIX

A.1 Electrical Parts Layout Diagram

A.1.1 Carrier, Safety Devices, and FL200

(1) Case of 520 mm staff and 120 spindle loom


GE
OE
FL
(INSIDE SUB-BOX)
SHOULDER COLLAPSE SENSOR
BOBBIN MISLOADING SENSOR (INSIDE FRAME)
(INSIDE FRAME)
PHR7
PHL8
PHL206
PHL207
PHL7
PHR8
PHR006 (INSIDE FRAME)
PHR007 (INSIDE FRAME)
EMERGENCY STOP BUTTON
PB3
PB4
RESET BUTTON
PHR1
PHR2
EMPTY-BOBBIN MISPLACEMENT SENSOR
TB36
TB38
SW2
PHR3
PHR4
PHR100
TB35
TB37
CARRIER DRIVE MOTOR
M1
FORK HORIZONTAL
PRS301
FORK ORIGIN
PRS300
FORK DRIVE MOTOR
M3
C1
C2
C3
C4
C5
C6
C7
C8
A1
A2
A3
A4
A5
A6
A7
A8
F1
F2
F3
F4
F5
F6
F7
F8
F9
TB11
TB12
TB13
TB14
TB15
TB16
TB17
ENCODER
PG1
PRS1
PRS2
PRS3
PRS4
PRS5
PRS11
PRS12
PRS13
PRS14
PRS15
FRAME UP DETECT
OVERRUN BACKWARD DETECT PRS102
OVERRUN FORWARD DETECT PRS101
ORIGIN DETECT PRS100
FULL-BOBBIN MISPLACEMENT SENSOR
CONTROL BOX
PHL1
PHL2
SAFETY DOOR
TB32
TB34
PHL3
PHL4
OBSTACLE AREA SENSOR
PHL100
TB31
SW1
TB33

Symbol	Parts Name	Symbol	Parts Name
PHR7	PHOTO RECEIVER, SHOULDER COLLAPSE	PHL7	LIGHT SOURCE, SHOULDER COLLAPSE
PHR8	PHOTO RECEIVER, FULL-BOBBIN	PHL8	LIGHT SOURCE, FULL-BOBBIN
PHR006	PHOTO RECEIVER, BOBBIN MISLOADING	PHL206	LIGHT SOURCE, BOBBIN MISLOADING
PHR007	PHOTO RECEIVER, BOBBIN MISLOADING	PHL207	LIGHT SOURCE, BOBBIN MISLOADING

Symbol	Parts Name	Symbol	Parts Name	Symbol	Parts Name	Symbol	Parts Name
M1	CARRIER DRIVE MOTOR	PRS15	PROXIMITY SWITCH, FRAME UP	TB13	TERMINAL BLOCK	TB38	TERMINAL BLOCK
M3	FORK DRIVE MOTOR	PRS100	PROXIMITY SWITCH, ORIGIN DETECT	TB14	TERMINAL BLOCK	PHR1	PHOTO RECEIVER, EMPTY-BOBBIN
PG1	ENCODER	PRS101	PROXIMITY SWITCH, OVERRUN FORWARD DETECT	TB15	TERMINAL BLOCK	PHR2	PHOTO RECEIVER, EMPTY-BOBBIN
PRS1	PROXIMITY SWITCH, FRAME UP	PRS102	PROXIMITY SWITCH, OVERRUN BACKWARD DETECT	TB16	TERMINAL BLOCK	PHR3	PHOTO RECEIVER, FULL-BOBBIN
PRS2	PROXIMITY SWITCH, FRAME UP	PRS300	PROXIMITY SWITCH, FORK ORIGIN	TB17	TERMINAL BLOCK	PHR4	PHOTO RECEIVER, FULL-BOBBIN
PRS3	PROXIMITY SWITCH, FRAME UP	PRS301	PROXIMITY SWITCH, FORK HORIZONTAL	TB31	TERMINAL BLOCK	PHR100	PHOTO RECEIVER, AREA SENSOR
PRS4	PROXIMITY SWITCH, FRAME UP	SW1	SAFETY SWITCH, SAFETY DOOR GE	TB32	TERMINAL BLOCK	PHL1	LIGHT SOURCE, EMPTY-BOBBIN
PRS5	PROXIMITY SWITCH, FRAME UP	SW2	SAFETY SWITCH, SAFETY DOOR OE	TB33	TERMINAL BLOCK	PHL2	LIGHT SOURCE, EMPTY-BOBBIN
PRS11	PROXIMITY SWITCH, FRAME UP	PB3	PUSH-BUTTON SWITCH, EMERGENCY STOP	TB34	TERMINAL BLOCK	PHL3	LIGHT SOURCE, FULL-BOBBIN
PRS12	PROXIMITY SWITCH, FRAME UP	PB4	PUSH-BUTTON SWITCH, RESET (SAFETY-DOOR)	TB35	TERMINAL BLOCK	PHL4	LIGHT SOURCE, FULL-BOBBIN
PRS13	PROXIMITY SWITCH, FRAME UP	TB11	TERMINAL BLOCK	TB36	TERMINAL BLOCK	PHL100	LIGHT SOURCE, AREA SENSOR
PRS14	PROXIMITY SWITCH, FRAME UP	TB12	TERMINAL BLOCK	TB37	TERMINAL BLOCK		

Symbol	Parts Name
F1–F9	CARRIER FRAME NO.
A1–A8	CARRIER ANGLE NO.
C1–C8	CARRIER CHANNEL NO.

Sensor name		Carrier frame for sensor installation						
		520 staff				440 staff		
		140 spindles	120 spindles	108 spindles	96 spindles	120 spindles	108 spindles	96 spindles
PRS1	PRS11	F1	F1	F1	F1	F1	F1	F1
PRS2	PRS12	F3	F3	F3	F3	F3	F3	F3
PRS3	PRS13	F5	F5	F5	F5	F4	F4	F4
PRS4	PRS14	F7	F7	F7	F7	F6	F6	F7
PRS5	PRS15	F9	F9	F9		F8	F8	
PRS6	PRS16	F10						

Motor name	Carrier angle for motor installation	
	520 staff	440 staff
M3	A4	A3
M1	A5	A4

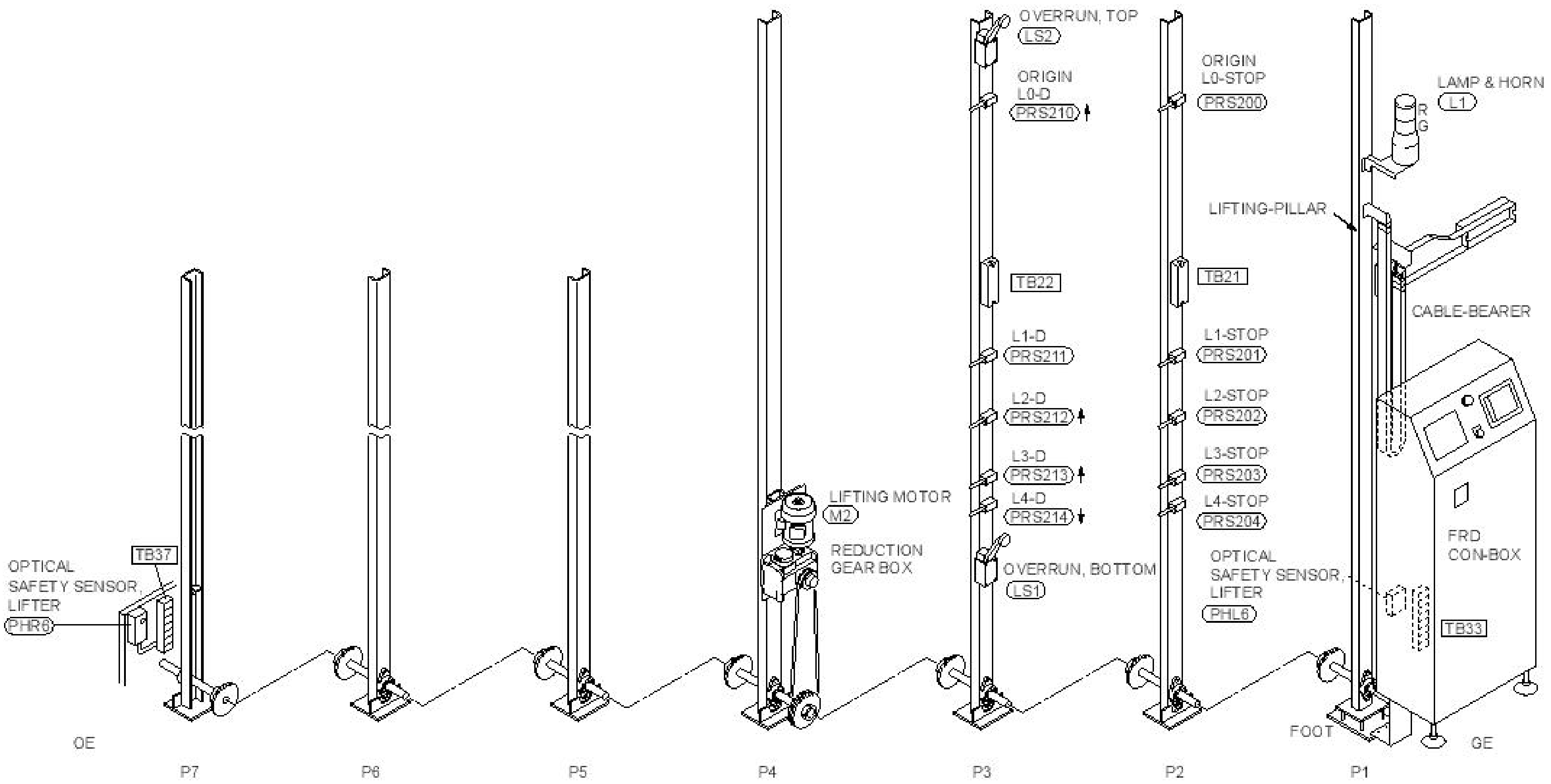
Terminal block name	Carrier for terminal board installation						
	520 staff				440 staff		
	140 spindles	120 spindles	108 spindles	96 spindles	120 spindles	108 spindles	96 spindles
TB11	C1						
TB12	C1						
TB13	C1						
TB14	C2						
TB15	C4				C3		C4
TB16	C6				C5		C6
TB17	C8		C7		C7		
TB18	C9						

REFERENCE: Installation position of the parts stated to the left differs by the staff number (520 mm/440 mm) and the number of spindle.

A.1.2 Lifter

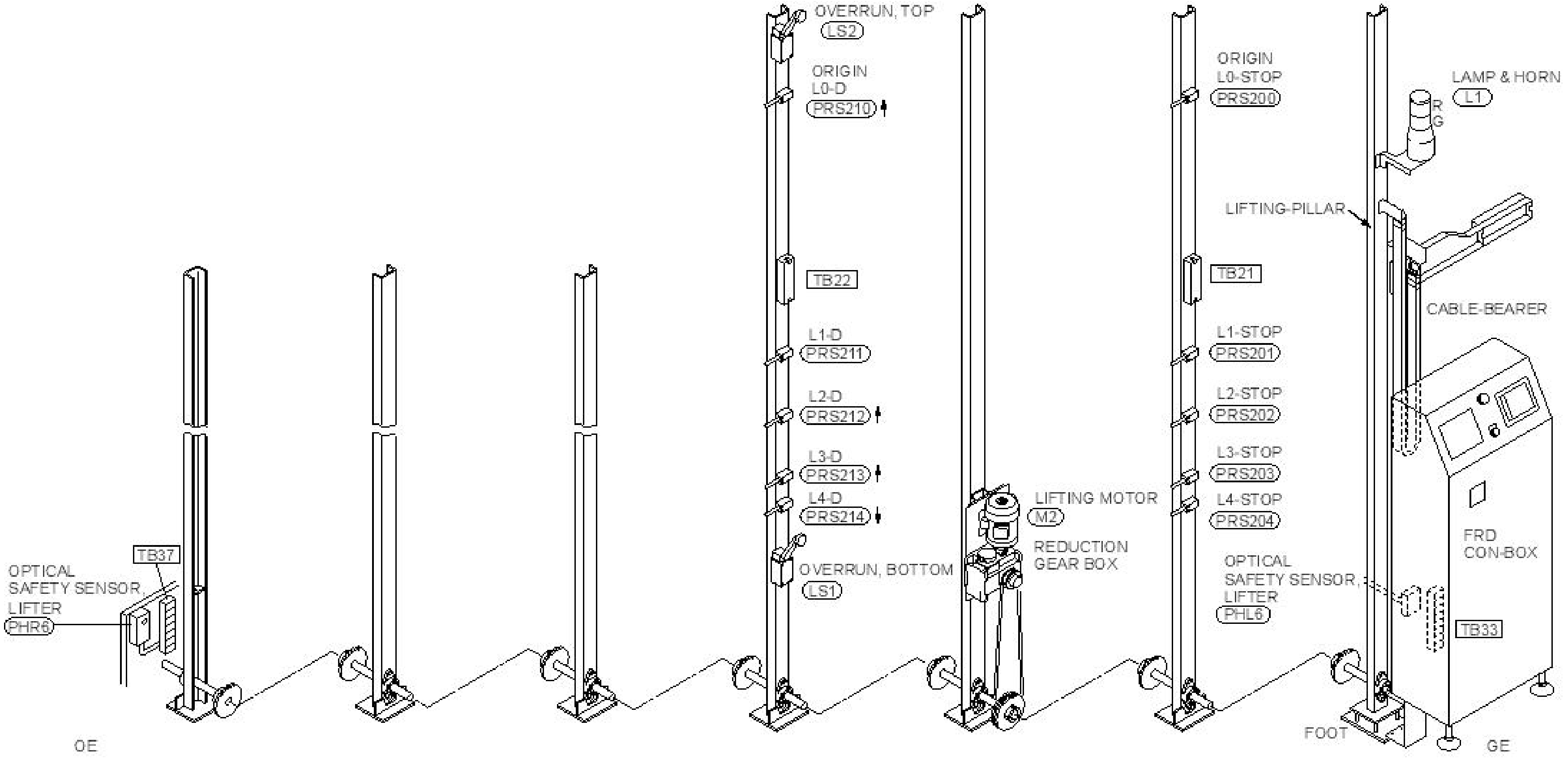
(1) Case of a 520 mm staff and 120 spindle loom

Symbol	Parts Name	Symbol	Parts Name
M2	LIFTING MOTOR	PRS200	PROXIMITY SWITCH, L0 (ORIGIN) STOP
L1	LAMP & HORN	PRS201	PROXIMITY SWITCH, L1 (ORIGIN) STOP
LS1	OVERRUN STOP (BOTTOM)	PRS202	PROXIMITY SWITCH, L2 (ORIGIN) STOP
LS2	OVERRUN STOP (TOP)	PRS203	PROXIMITY SWITCH, L3 (ORIGIN) STOP
TB21	TERMINAL BLOCK	PRS204	PROXIMITY SWITCH, L4 (ORIGIN) STOP
TB22	TERMINAL BLOCK	PRS210	PROXIMITY SWITCH, L0 (ORIGIN) DECREASE
TB33	TERMINAL BLOCK	PRS211	PROXIMITY SWITCH, L1 (ORIGIN) DECREASE
TB37	TERMINAL BLOCK	PRS212	PROXIMITY SWITCH, L2 (ORIGIN) DECREASE
PHL6	LIGHT SOURCE, LIFTER OPTICAL SAFETY SENSOR	PRS213	PROXIMITY SWITCH, L3 (ORIGIN) DECREASE
PHR6	PHOTO RECEIVER, LIFTER OPTICAL SAFETY SENSOR	PRS214	PROXIMITY SWITCH, L4 (ORIGIN) DECREASE


OVERRUN, TOP
LS2
ORIGIN
L0-D
PRS210
ORIGIN
L0-STOP
PRS200
LAMP & HORN
L1
R
G
LIFTING-PILLAR
TB22
TB21
CABLE-BEARER
L1-D
PRS211
L1-STOP
PRS201
L2-D
PRS212
L2-STOP
PRS202
L3-D
PRS213
L3-STOP
PRS203
L4-D
PRS214
L4-STOP
PRS204
LIFTING MOTOR
M2
REDUCTION
GEAR BOX
OVERRUN, BOTTOM
LS1
OPTICAL
SAFETY SENSOR,
LIFTER
PHL6
FRD
CON-BOX
TB33
TB37
OPTICAL
SAFETY SENSOR,
LIFTER
PHR6
FOOT
OE
GE
P7
P6
P5
P4
P3
P2
P1

(2) Case of a 440 mm staff and 120 spindle loom

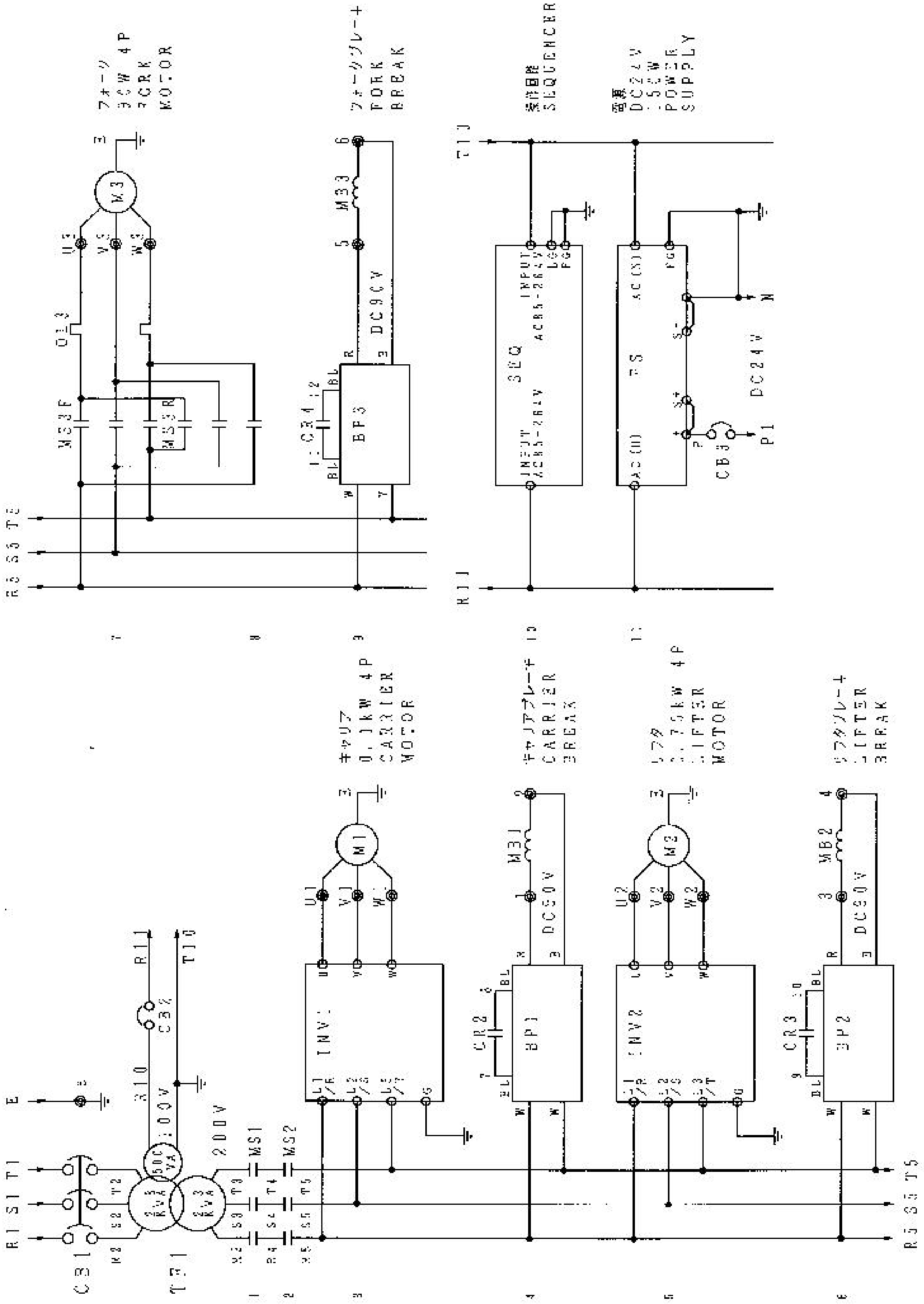
Symbol	Parts Name	Symbol	Parts Name
M2	LIFTING MOTOR	PRS200	PROXIMITY SWITCH, L0 (ORIGIN) STOP
L1	LAMP & HORN	PRS201	PROXIMITY SWITCH, L1 (ORIGIN) STOP
LS1	OVERRUN STOP (BOTTOM)	PRS202	PROXIMITY SWITCH, L2 (ORIGIN) STOP
LS2	OVERRUN STOP (TOP)	PRS203	PROXIMITY SWITCH, L3 (ORIGIN) STOP
TB21	TERMINAL BLOCK	PRS204	PROXIMITY SWITCH, L4 (ORIGIN) STOP
TB22	TERMINAL BLOCK	PRS210	PROXIMITY SWITCH, L0 (ORIGIN) DECREASE
TB33	TERMINAL BLOCK	PRS211	PROXIMITY SWITCH, L1 (ORIGIN) DECREASE
TB37	TERMINAL BLOCK	PRS212	PROXIMITY SWITCH, L2 (ORIGIN) DECREASE
PHL6	LIGHT SOURCE, LIFTER OPTICAL SAFETY SENSOR	PRS213	PROXIMITY SWITCH, L3 (ORIGIN) DECREASE
PHR6	PHOTO RECEIVER, LIFTER OPTICAL SAFETY SENSOR	PRS214	PROXIMITY SWITCH, L4 (ORIGIN) DECREASE


OPTICAL
SAFETY SENSOR
LIFTER
PHR6
TB37
OE
OVERRUN, TOP
LS2
ORIGIN
L0-D
PRS210
TB22
L1-D
PRS211
L2-D
PRS212
L3-D
PRS213
L4-D
PRS214
OVERRUN, BOTTOM
LS1
LIFTING MOTOR
M2
REDUCTION
GEAR BOX
ORIGIN
L0-STOP
PRS200
LIFTING-PILLAR
TB21
L1-STOP
PRS201
L2-STOP
PRS202
L3-STOP
PRS203
L4-STOP
PRS204
OPTICAL
SAFETY SENSOR,
LIFTER
PHL6
FOOT
LAMP & HORN
L1
R
G
CABLE-BEARER
FRD
CON-BOX
TB33
GE

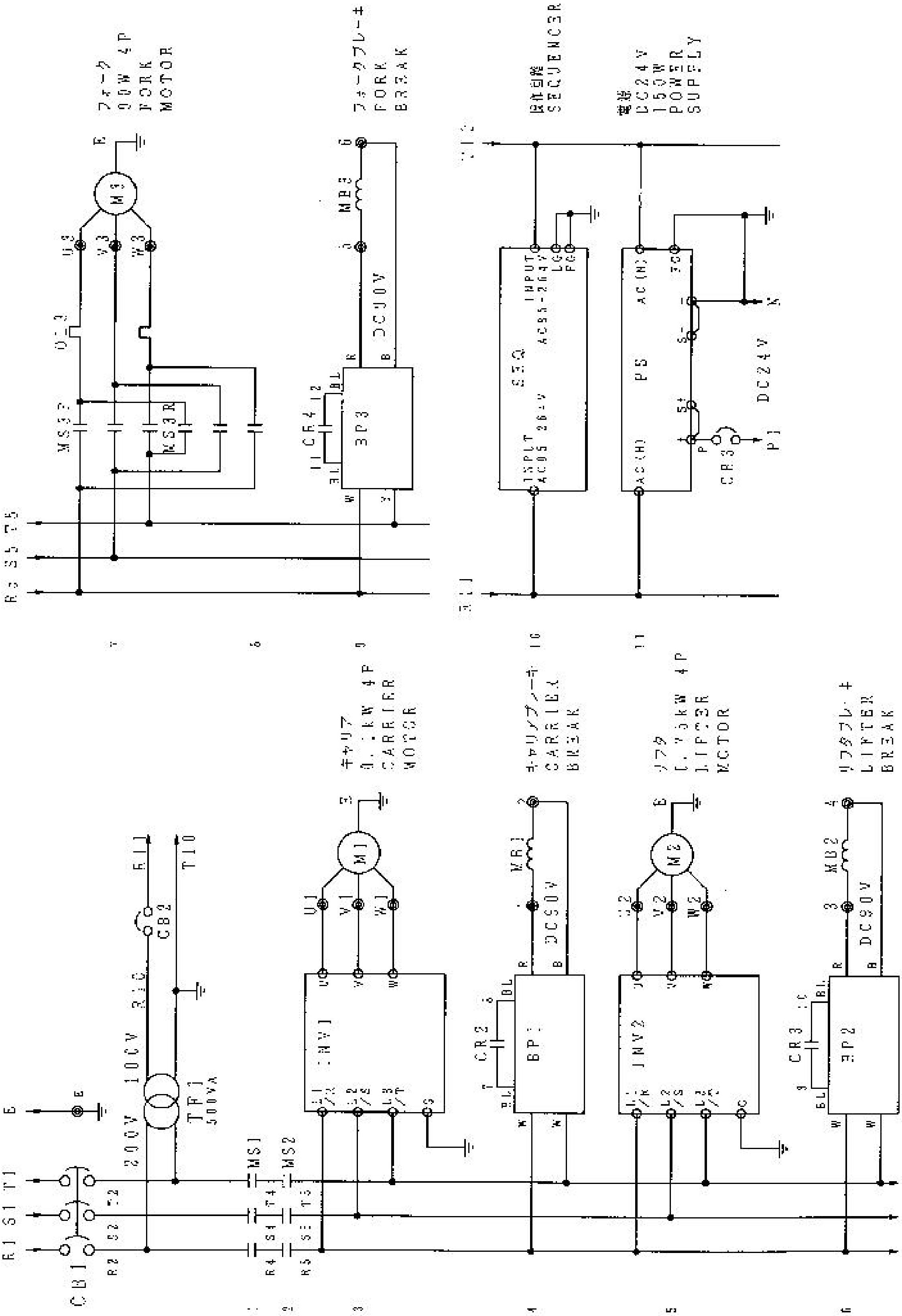
A.2 Drawing of Electrical Equipment

A.2.1 Circuit Diagram

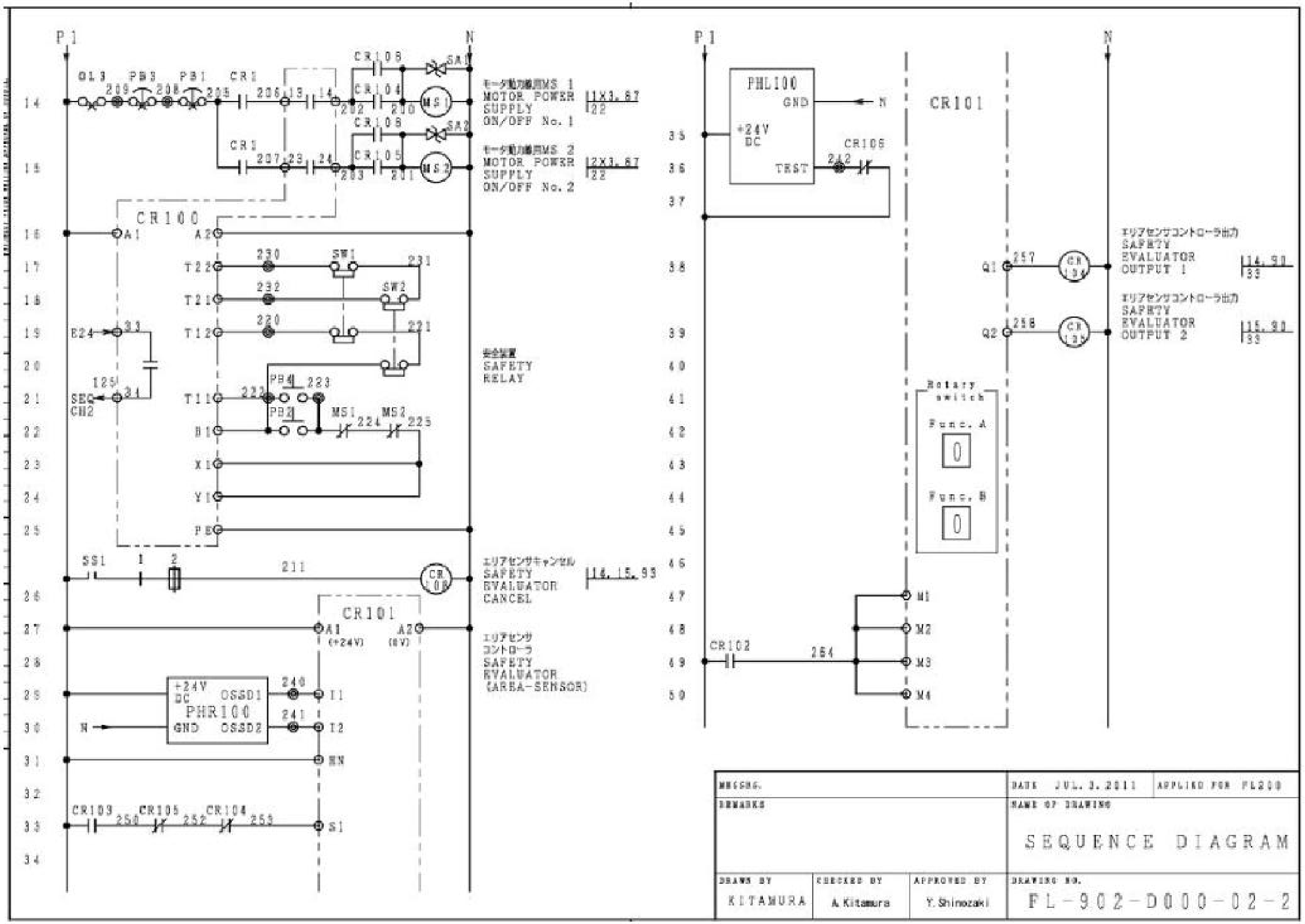
[1] Circuit Diagram 1 (Power Supply Voltage: 220 V to 460 V)


CB1
R1 S1 T1
E
TR1
200V
100V
CB2
R10
T10
R11
T11
MS1
MS2
R5 S5 T5
INV1
INV2
M1
M2
M3
U1 V1 W1
U2 V2 W2
U3 V3 W3
BP1
BP2
BP3
CR2
CR3
CR4
MB1
MB2
MB3
DC90V
キャリア 0.1KW 4P CARRIER MOTOR
キャリアブレーキ CARRIER BREAK
リフタ 0.75KW 4P LIFTER MOTOR
リフタブレーキ LIFTER BREAK
フォーク FORK MOTOR
フォークブレーキ FORK BREAK
OL3
MS3F
MS3R
SEQ
SEQUENCER
PS
DC24V POWER SUPPLY
CB3
P1
N
DC24V

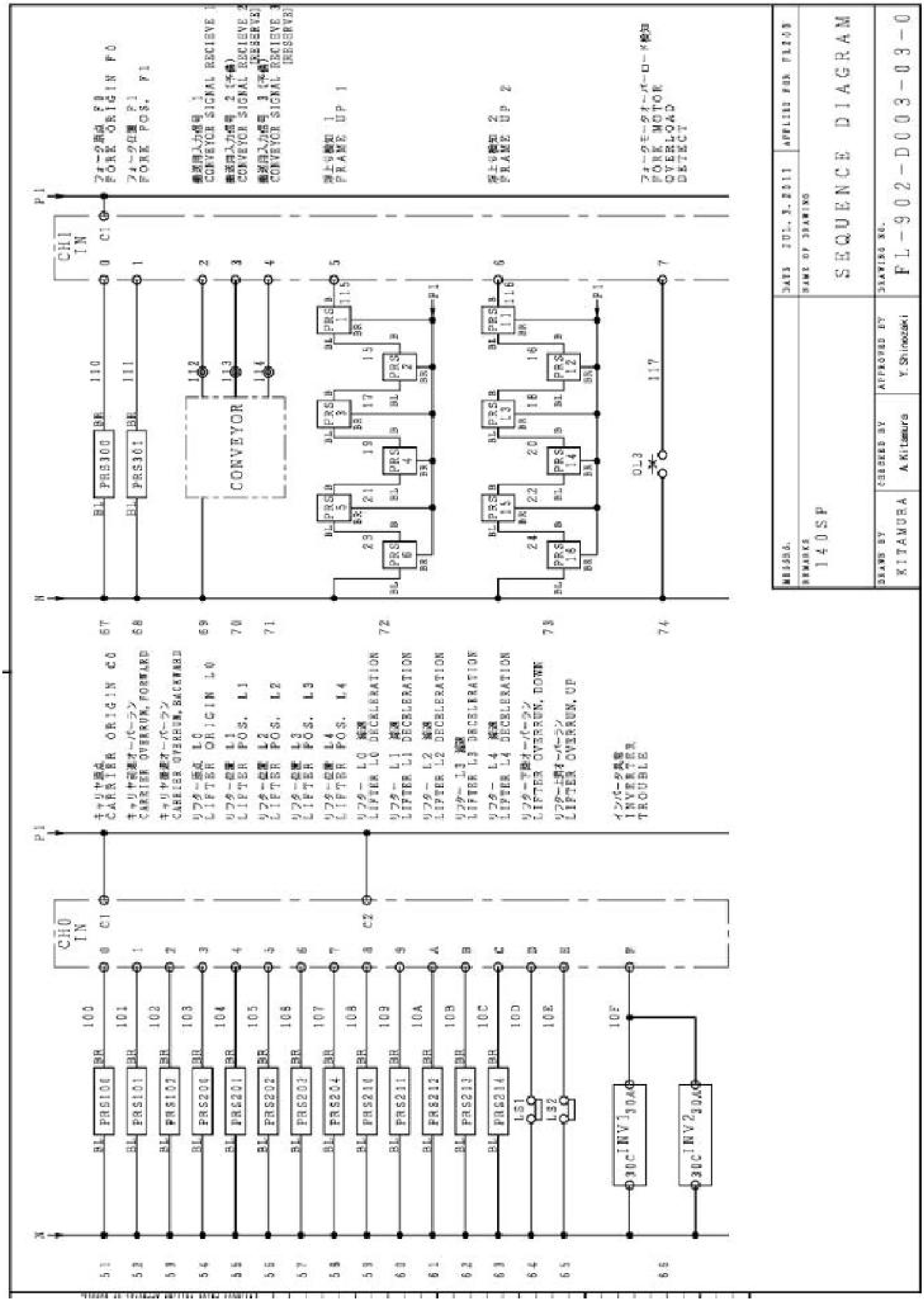
[2] Circuit Diagram 1 (Power Supply Voltage: 200 V)


CB1
R1 S1 T1
R2 S2 T2
E
200V
TR1
500VA
100V
CB2
R11
T10
MS1
MS2
R4 S4 T4
R5 S5 T5
INV1
U1 V1 W1
M1
キャリア
0.1kW 4P
CARRIER
MOTOR
CR2
BP1
MB1
DC90V
キャリアブレーキ
CARRIER
BREAK
INV2
U2 V2 W2
M2
リフタ
0.75kW 4P
LIFTER
MOTOR
CR3
BP2
MB2
DC90V
リフタブレーキ
LIFTER
BREAK
MS3F
MS3R
OL3
U3 V3 W3
M3
フォーク
90W 4P
FORK
MOTOR
CR4
BP3
MB3
DC90V
フォークブレーキ
FORK
BREAK
SEQ
INPUT
AC85-264V
LG
FG
PS
AC(H)
AC(N)
S+
S-
DC24V
CR5
P1
N1
DC24V
150W
POWER
SUPPLY
1
2
3
4
5
6
7
8
9
10
11

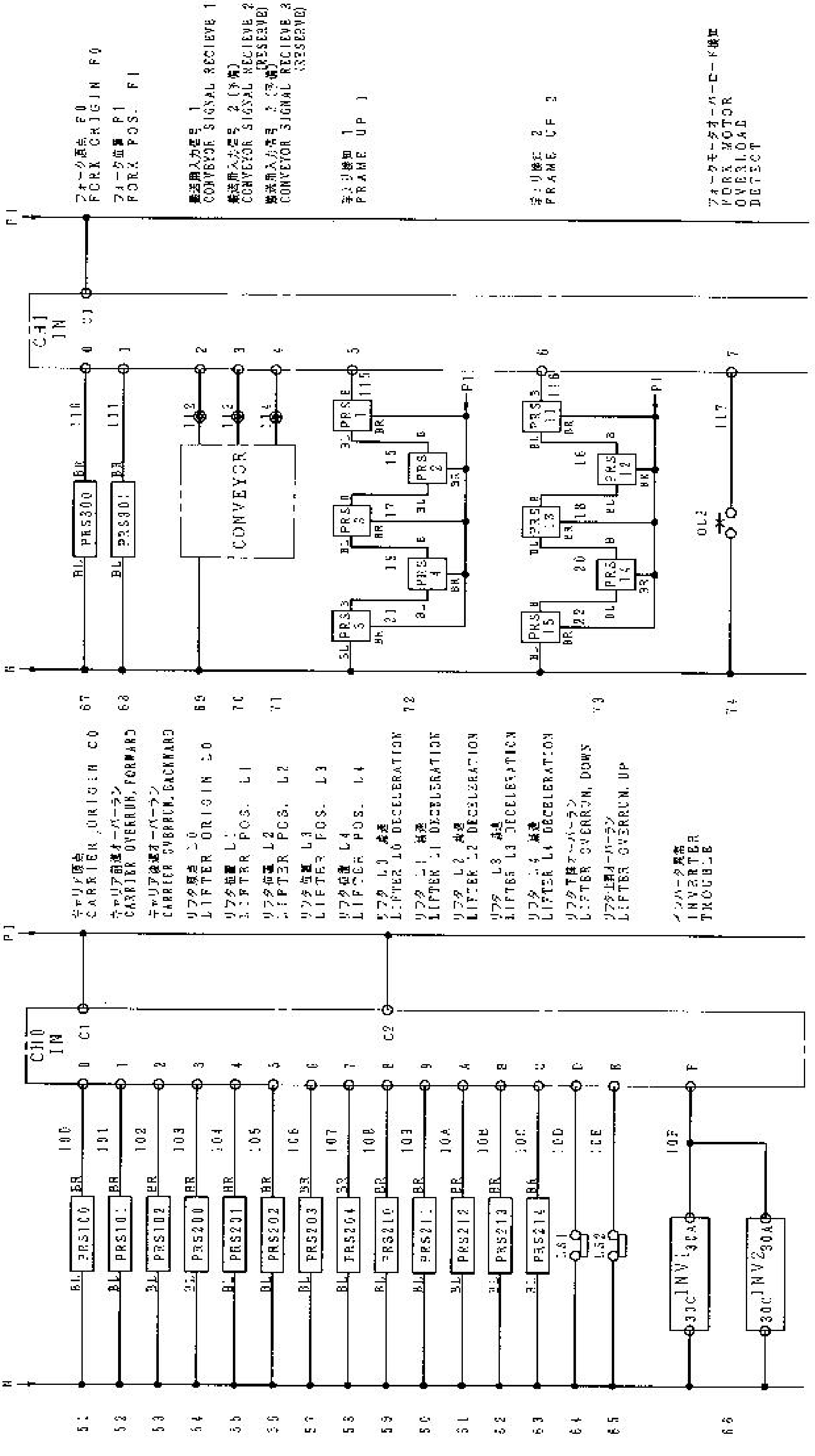
[3] Circuit Diagram 2


P1
N
OL3
PB3
PB1
CR1
209
208
205
206
13
14
202
210
207
23
24
203
211
CR108
CR104
CR105
SA1
SA2
MS1
MS2
モータ動力電源MS 1
MOTOR POWER
SUPPLY
ON/OFF No. 1
1X3, 87
22
モータ動力電源MS 2
MOTOR POWER
SUPPLY
ON/OFF No. 2
2X3, 87
22
CR100
A1
A2
T22
T21
T12
T11
B1
X1
Y1
PE
230
232
220
231
221
222
223
224
225
SW1
SW2
PB4
PB2
E24
33
34
125
SEQ
CH2
安全装置
SAFETY
RELAY
SS1
1
2
211
CR
108
エリアセンサキャンセル
SAFETY
EVALUATOR
CANCEL
14, 15, 93
CR101
A1
(+24V)
A2
(0V)
エリアセンサ
コントローラ
SAFETY
EVALUATOR
(AREA-SENSOR)
+24V
DC
OSSD1
OSSD2
PHR100
GND
240
241
I1
I2
EN
S1
CR103
250
CR105
252
CR104
253
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
PHL100
GND
+24V
DC
TEST
CR106
242
Q1
Q2
257
258
CR
134
CR
135
エリアセンサコントローラ出力
SAFETY
EVALUATOR
OUTPUT 1
14, 90
33
エリアセンサコントローラ出力
SAFETY
EVALUATOR
OUTPUT 2
15, 90
33
Rotary
switch
Func. A
0
Func. B
0
M1
M2
M3
M4
CR102
264
MSGSG.
REMARKS
DATE JUL. 3. 2011
APPLIED FOR FL200
NAME OF DRAWING
SEQUENCE DIAGRAM
DRAWN BY
KITAMURA
CHECKED BY
A. Kitamura
APPROVED BY
Y. Shinozaki
DRAWING NO.
FL-902-D000-02-2

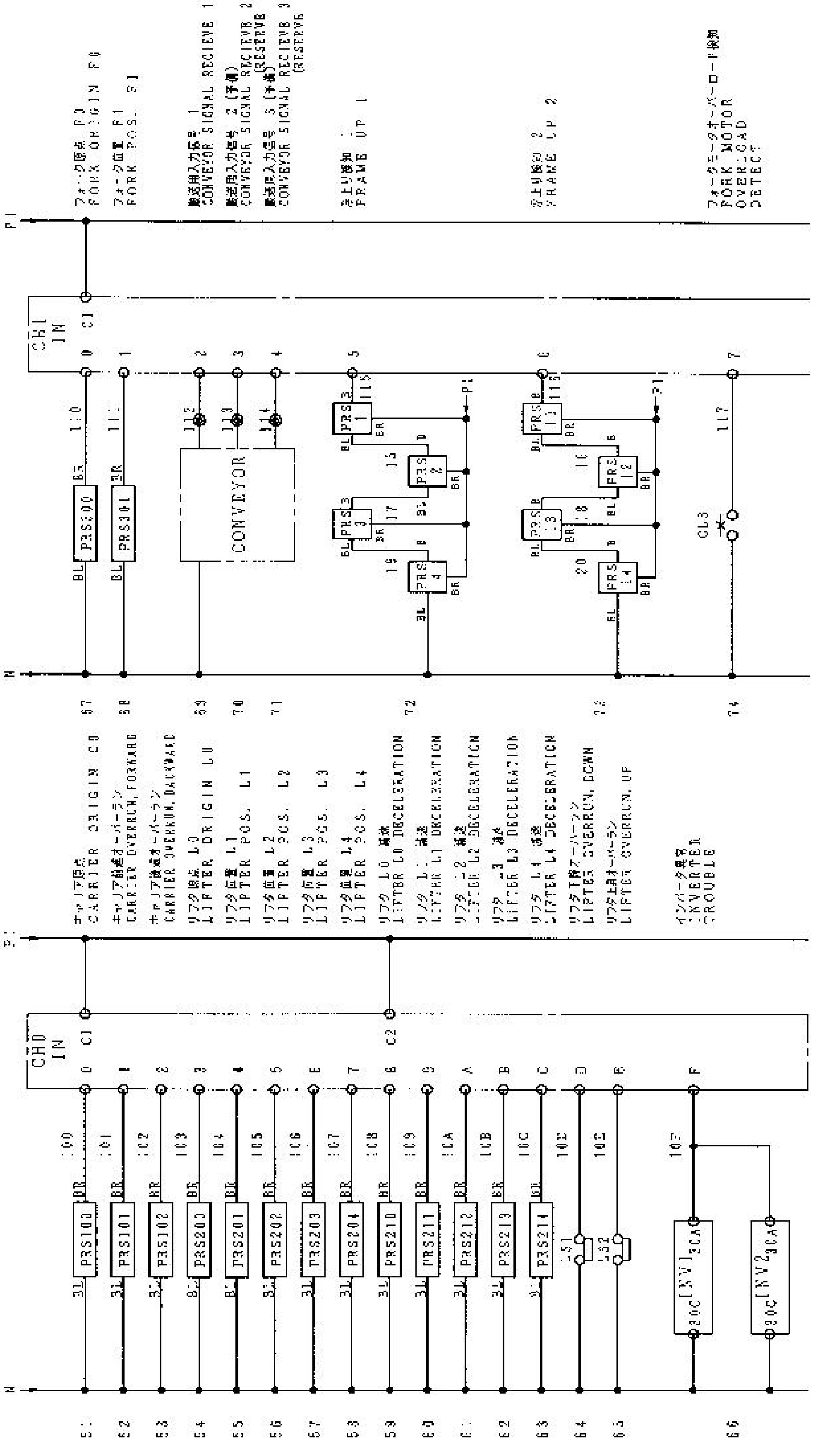
[4] Circuit Diagram 3 (Number of Spindles: 140)


P1
N
CH1 IN
CH0 IN
C1
C2
PRS300
PRS301
CONVEYOR
FORK ORIGIN F0
FORK POS. F1
CONVEYOR SIGNAL RECIEVE 1
CONVEYOR SIGNAL RECIEVE 2 (RESERVE)
CONVEYOR SIGNAL RECIEVE 3 (RESERVE)
FRAME UP 1
FRAME UP 2
FORK MOTOR OVERLOAD DETECT
DL3
CARRIER ORIGIN C0
CARRIER OVERRUN, FORWARD
CARRIER OVERRUN, BACKWARD
LIFTER ORIGIN L0
LIFTER POS. L1
LIFTER POS. L2
LIFTER POS. L3
LIFTER POS. L4
LIFTER L0 DECELERATION
LIFTER L1 DECELERATION
LIFTER L2 DECELERATION
LIFTER L3 DECELERATION
LIFTER L4 DECELERATION
LIFTER OVERRUN, DOWN
LIFTER OVERRUN, UP
INVERTER TROUBLE
PRS100
PRS101
PRS102
PRS200
PRS201
PRS202
PRS203
PRS204
PRS210
PRS211
PRS212
PRS213
PRS214
LS1
LS2
INV1 30A 30C
INV2 30A 30C
BL
BR
MESSRS.
REMARKS
140SP
DRAWN BY
KITAMURA
CHECKED BY
A.Kitamura
APPROVED BY
Y.Shinozaki
DATE
JUL. 3. 2011
APPLIED FOR
NAME OF DRAWING
SEQUENCE DIAGRAM
DRAWING NO.
FL-902-D003-03-0

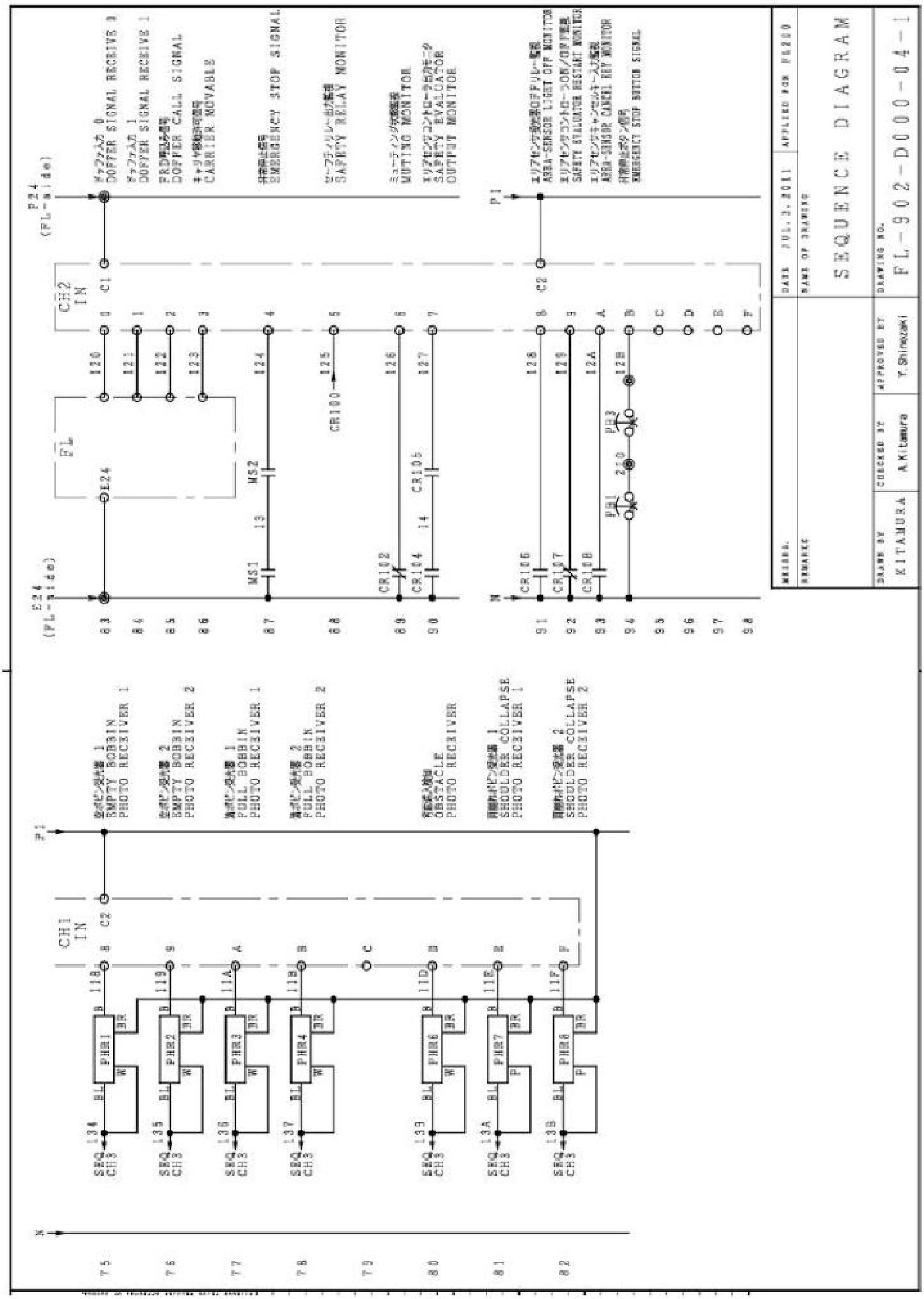
[5] Circuit Diagram 3 (Number of Spindles: 108 or 120)


フォーク原点 F0 FORK ORIGIN F0
フォーク位置 F1 FORK POS. F1
搬送用入力信号 1 CONVEYOR SIGNAL RECIEVE 1
搬送用入力信号 2 (予備) CONVEYOR SIGNAL RECIEVE 2 (RESERVED)
搬送用入力信号 3 (予備) CONVEYOR SIGNAL RECIEVE 3 (RESERVED)
手ぶり検知 1 FRAME UP 1
手ぶり検知 2 FRAME UP 2
フォークモーターオーバーロード検出 FORK MOTOR OVERLOAD DETECT
P1
N
CH1 IN
CONVEYOR
PRS300
PRS301
PRS 1
PRS 2
PRS 3
PRS 4
PRS 5
PRS 11
PRS 12
PRS 13
PRS 14
PRS 15
OL2
キャリア原点 CARRIER ORIGIN C0
キャリア前進オーバーラン CARRIER OVERRUN, FORWARD
キャリア後退オーバーラン CARRIER OVERRUN, BACKWARD
リフタ原点 L0 LIFTER ORIGIN L0
リフタ位置 L1 LIFTER POS. L1
リフタ位置 L2 LIFTER POS. L2
リフタ位置 L3 LIFTER POS. L3
リフタ位置 L4 LIFTER POS. L4
リフタ L0 減速 LIFTER L0 DECELERATION
リフタ L1 減速 LIFTER L1 DECELERATION
リフタ L2 減速 LIFTER L2 DECELERATION
リフタ L3 減速 LIFTER L3 DECELERATION
リフタ L4 減速 LIFTER L4 DECELERATION
リフタ下降オーバーラン LIFTER OVERRUN, DOWN
リフタ上昇オーバーラン LIFTER OVERRUN, UP
インバータ異常 INVERTER TROUBLE
CH10 IN
C1
C2
PRS100
PRS101
PRS102
PRS200
PRS201
PRS202
PRS203
PRS204
PRS210
PRS211
PRS212
PRS213
PRS214
LS1
LS2
INV1 30A 30C
INV2 30A 30C
BL
BR

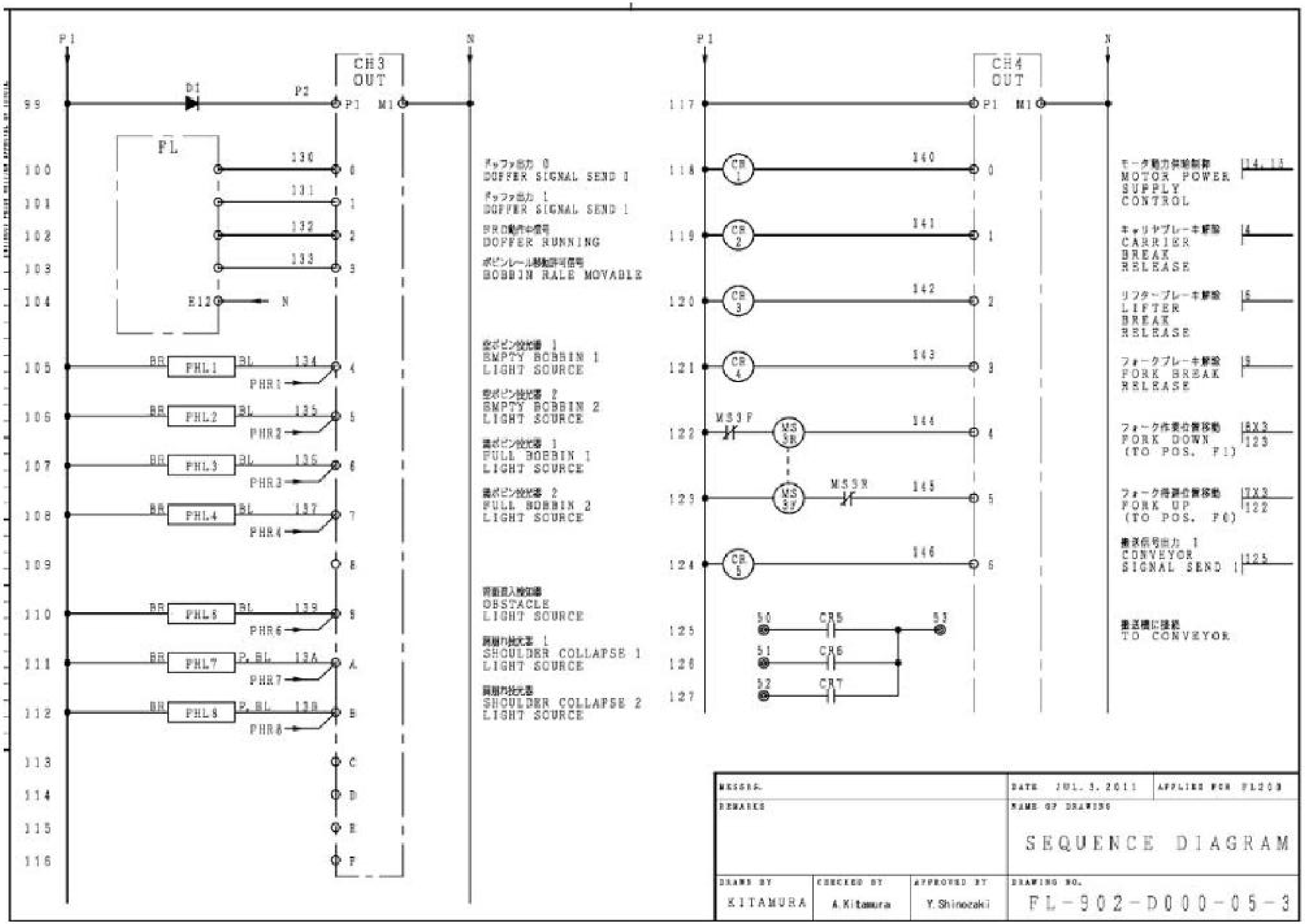
[6] Circuit Diagram 3 (Number of Spindles: 96)


N
P1
CH0
IN
CH1
IN
C1
C2
PRS100
PRS101
PRS102
PRS200
PRS201
PRS202
PRS203
PRS204
PRS210
PRS211
PRS212
PRS213
PRS214
LS1
LS2
INV1
INV2
30C
30CA
PRS300
PRS301
CONVEYOR
PRS 1
PRS 2
PRS 3
PRS 4
PRS 11
PRS 12
PRS 13
PRS 14
CL3
BL
BR
キャリア原点
CARRIER ORIGIN C0
キャリア前進オーバーラン
CARRIER OVERRUN, FORWARD
キャリア後進オーバーラン
CARRIER OVERRUN, BACKWARD
リフタ原点 L0
LIFTER ORIGIN L0
リフタ位置 L1
LIFTER POS. L1
リフタ位置 L2
LIFTER POS. L2
リフタ位置 L3
LIFTER POS. L3
リフタ位置 L4
LIFTER POS. L4
リフタ L0 減速
LIFTER L0 DECELERATION
リフタ L1 減速
LIFTER L1 DECELERATION
リフタ L2 減速
LIFTER L2 DECELERATION
リフタ L3 減速
LIFTER L3 DECELERATION
リフタ L4 減速
LIFTER L4 DECELERATION
リフタ下降オーバーラン
LIFTER OVERRUN, DOWN
リフタ上昇オーバーラン
LIFTER OVERRUN, UP
インバータ異常
INVERTER TROUBLE
フォーク原点 F0
FORK ORIGIN F0
フォーク位置 F1
FORK POS. F1
搬送用入力信号 1
CONVEYOR SIGNAL RECIEVE 1
搬送用入力信号 2 (予備)
CONVEYOR SIGNAL RECIEVE 2 (RESERVE
搬送用入力信号 3 (予備)
CONVEYOR SIGNAL RECIEVE 3 (RESERVE
浮上り検知 1
FRAME UP 1
浮上り検知 2
FRAME UP 2
フォークモータオーバーロード検知
FORK MOTOR OVERLOAD DETECT
100
101
102
103
104
105
106
107
108
109
10A
10B
10C
10D
10E
10F
110
111
112
113
114
115
116
117
15
16
17
18
19
20
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74

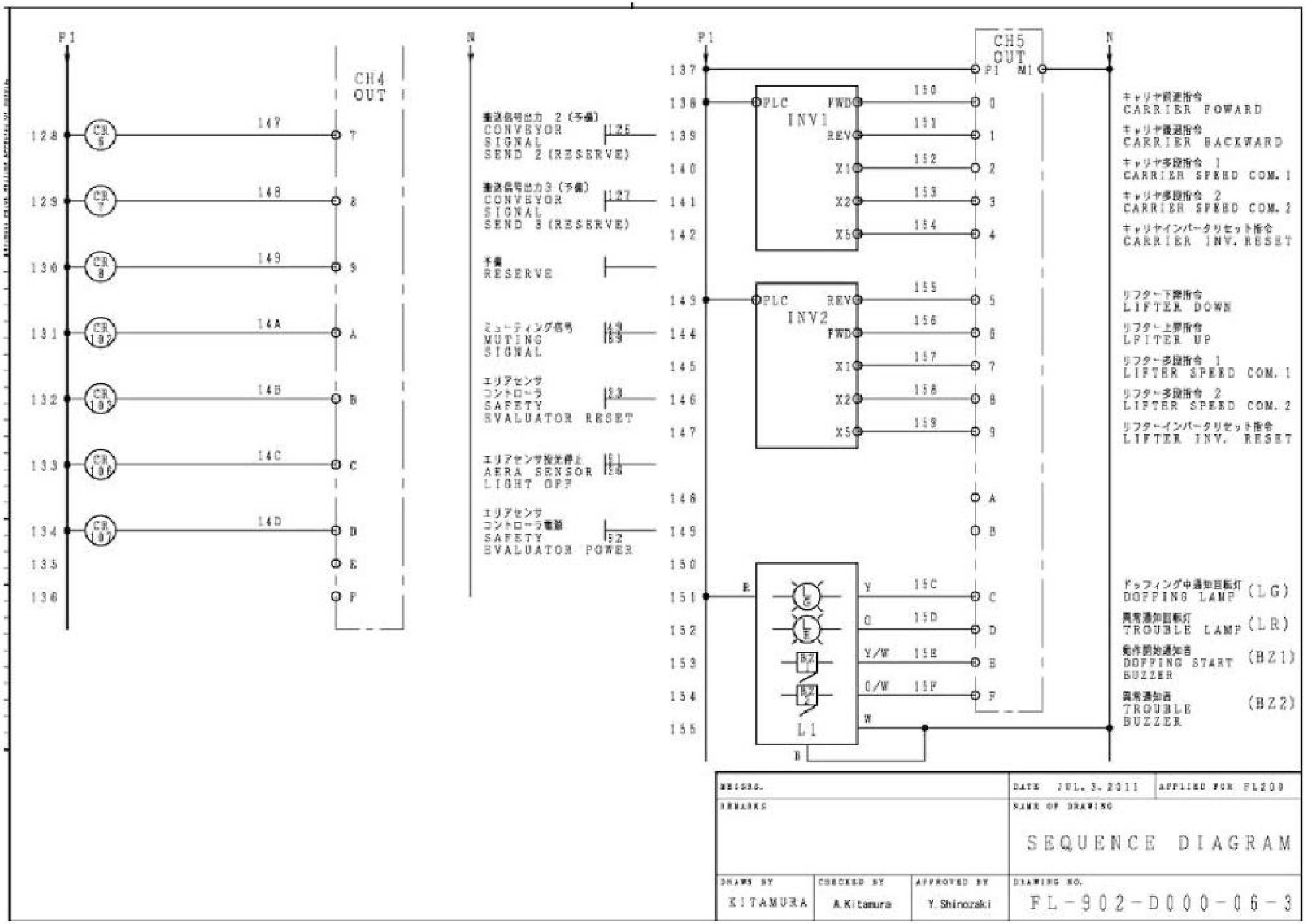
[7] Circuit Diagram 4


SEQUENCE DIAGRAM
DRAWING NO. FL-902-D000-04-1
APPLIED FOR FS200
DATE JUL.3.2011
NAME OF DRAWING
REMARKS
DRAWN BY KITAMURA
CHECKED BY A.Kitamura
APPROVED BY Y.Shimozaki
P24 (FL-side)
E24 (FL-side)
CH2 IN
CH1 IN
FL
P1
N
DOFFER SIGNAL RECEIVE 0
DOFFER SIGNAL RECEIVE 1
DOFFER CALL SIGNAL
CARRIER MOVABLE
EMERGENCY STOP SIGNAL
SAFETY RELAY MONITOR
MUTING MONITOR
SAFETY EVALUATOR OUTPUT MONITOR
AREA-SENSOR LIGHT OFF MONITOR
SAFETY EVALUATOR RESTART MONITOR
AREA-SENSOR CANCEL KEY MONITOR
EMERGENCY STOP BUTTON SIGNAL
EMPTY BOBBIN PHOTO RECEIVER 1
EMPTY BOBBIN PHOTO RECEIVER 2
FULL BOBBIN PHOTO RECEIVER 1
FULL BOBBIN PHOTO RECEIVER 2
OBSTACLE PHOTO RECEIVER
SHOULDER COLLAPSE PHOTO RECEIVER 1
SHOULDER COLLAPSE PHOTO RECEIVER 2
MS1
MS2
CR100
CR102
CR104
CR105
CR106
CR107
CR108
PH1
PH3
PHR1
PHR2
PHR3
PHR4
PHR6
PHR7
PHR8
SEQ CH3

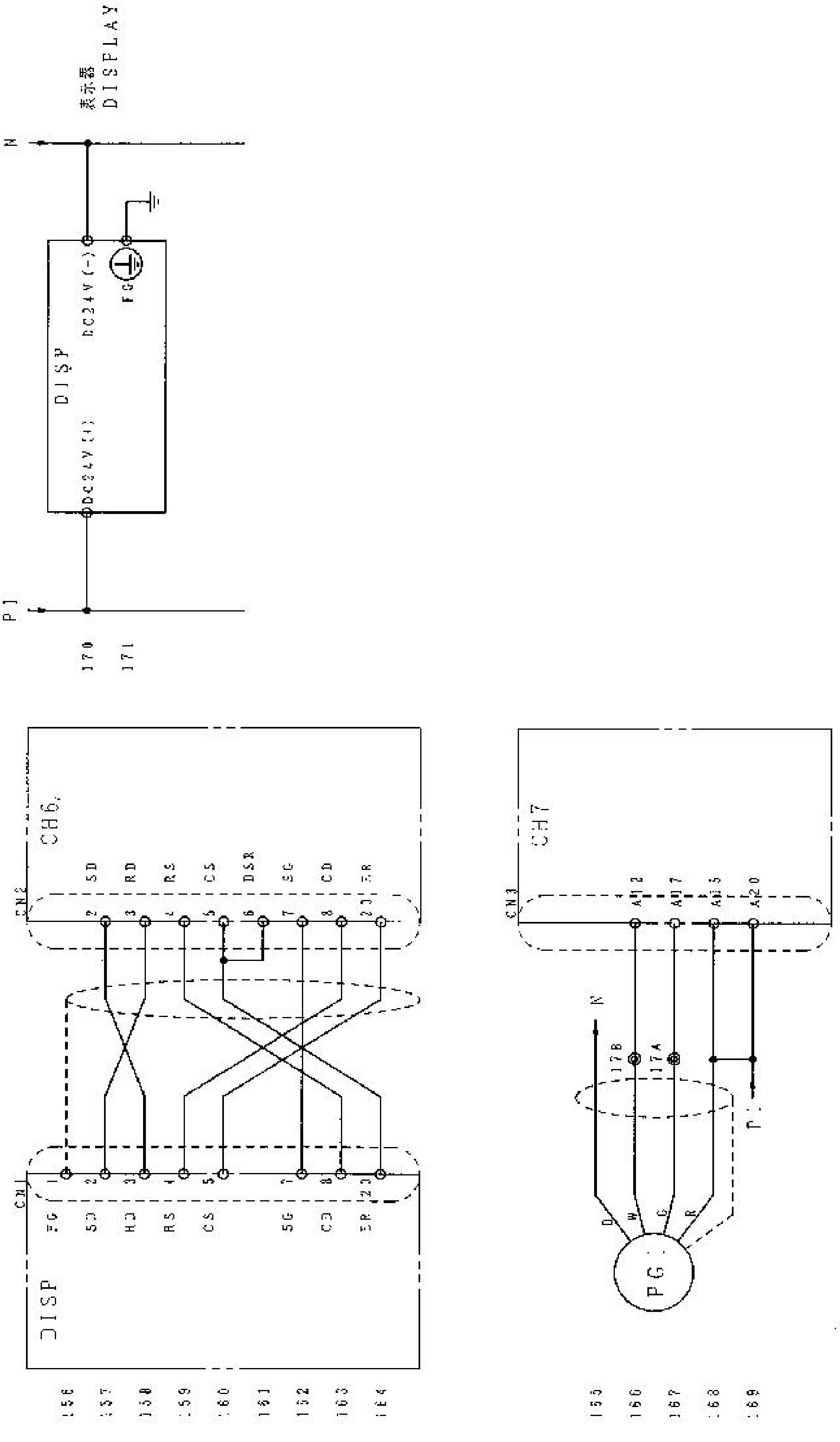
[8] Circuit Diagram 5


P1
N
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
D1
P2
CH3 OUT
P1
M1
FL
130
131
132
133
E12
PHL1
PHL2
PHL3
PHL4
PHL6
PHL7
PHL8
BR
BL
P.BL
134
135
136
137
139
13A
13B
PHR1
PHR2
PHR3
PHR4
PHR6
PHR7
PHR8
0
1
2
3
4
5
6
7
8
9
A
B
C
D
E
F
ドッファ出力 0
DOFFER SIGNAL SEND 0
ドッファ出力 1
DOFFER SIGNAL SEND 1
BRD動作中信号
DOFFER RUNNING
ボビンレール移動許可信号
BOBBIN RALE MOVABLE
空ボビン投光器 1
EMPTY BOBBIN 1
LIGHT SOURCE
空ボビン投光器 2
EMPTY BOBBIN 2
LIGHT SOURCE
満ボビン投光器 1
FULL BOBBIN 1
LIGHT SOURCE
満ボビン投光器 2
FULL BOBBIN 2
LIGHT SOURCE
背面侵入検知器
OBSTACLE
LIGHT SOURCE
肩崩れ投光器 1
SHOULDER COLLAPSE 1
LIGHT SOURCE
肩崩れ投光器
SHOULDER COLLAPSE 2
LIGHT SOURCE
117
118
119
120
121
122
123
124
125
126
127
CH4 OUT
CR 1
CR 2
CR 3
CR 4
CR 5
MS3F
MS 3R
MS 3F
MS3R
140
141
142
143
144
145
146
50
51
52
53
CR5
CR6
CR7
モータ動力供給制御
MOTOR POWER
SUPPLY
CONTROL
14, 15
キャリヤブレーキ解除
CARRIER
BREAK
RELEASE
4
リフターブレーキ解除
LIFTER
BREAK
RELEASE
5
フォークブレーキ解除
FORK BREAK
RELEASE
5
フォーク作業位置移動
FORK DOWN
(TO POS. F1)
8X3
123
フォーク待避位置移動
FORK UP
(TO POS. F0)
7X3
122
搬送信号出力 1
CONVEYOR
SIGNAL SEND 1
125
搬送機に接続
TO CONVEYOR
MESSRS.
DATE JUL. 3. 2011
APPLIES FOR FL203
REMARKS
NAME OF DRAWING
SEQUENCE DIAGRAM
DRAWN BY
KITAMURA
CHECKED BY
A.Kitamura
APPROVED BY
Y.Shinozaki
DRAWING NO.
FL-902-D000-05-3

[9] Circuit Diagram 6

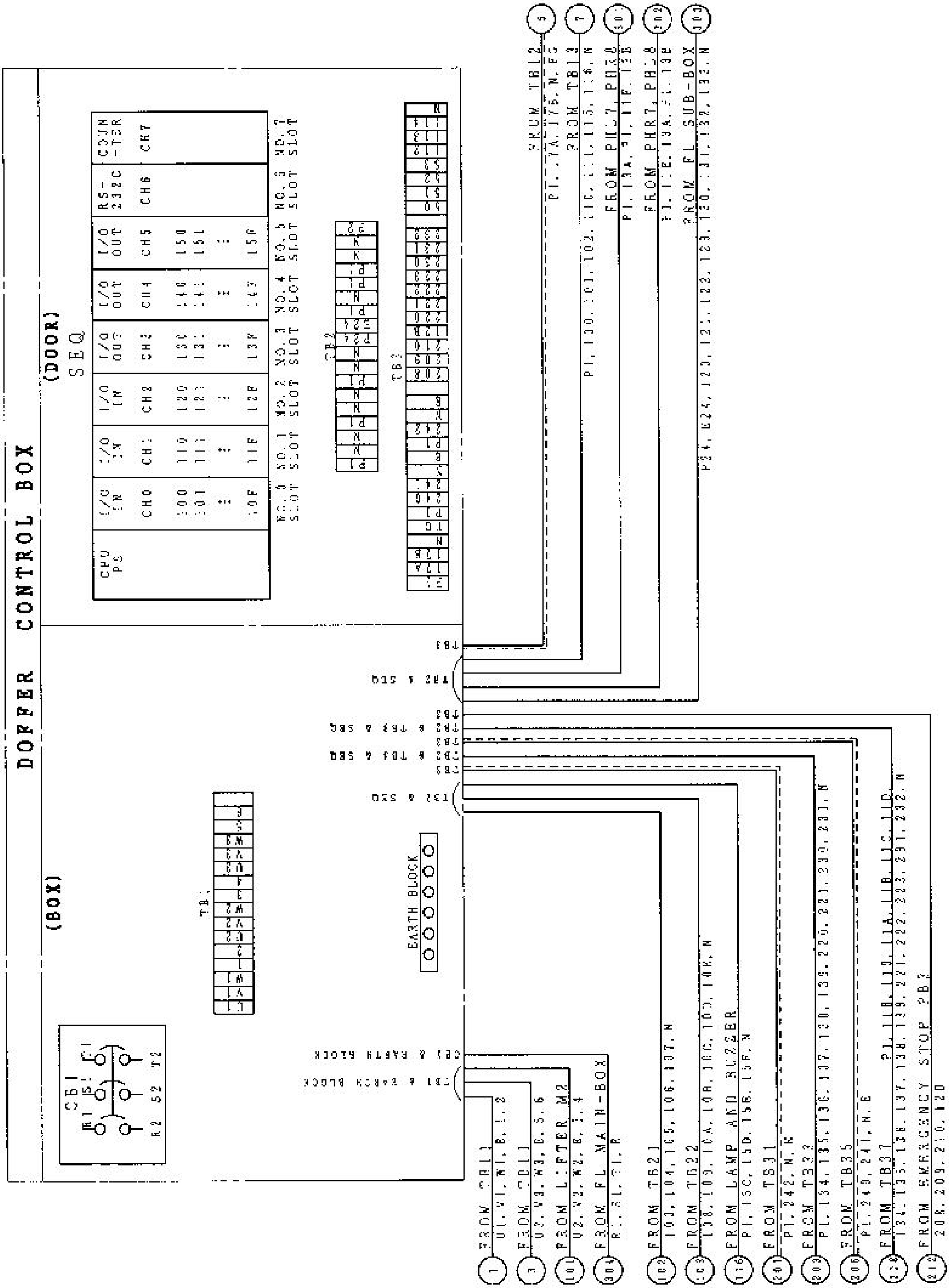

P1
N
P1
N
CH4
OUT
CH5
OUT
128
129
130
131
132
133
134
135
136
CR 6
CR 7
CR 8
CR 102
CR 103
CR 106
CR 107
147
148
149
14A
14B
14C
14D
7
8
9
A
B
C
D
E
F
搬送信号出力 2（予備）
CONVEYOR
SIGNAL
SEND 2（RESERVE）
125
搬送信号出力3（予備）
CONVEYOR
SIGNAL
SEND 3（RESERVE）
127
予備
RESERVE
ミューティング信号
MUTING
SIGNAL
49
69
エリアセンサ
コントローラ
SAFETY
EVALUATOR RESET
33
エリアセンサ投光停止
AERA SENSOR
LIGHT OFF
51
28
エリアセンサ
コントローラ電源
SAFETY
EVALUATOR POWER
52
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
PLC
INV1
FWD
REV
X1
X2
X5
PLC
INV2
REV
FWD
X1
X2
X5
150
151
152
153
154
155
156
157
158
159
15C
15D
15E
15F
P1
M1
0
1
2
3
4
5
6
7
8
9
A
B
C
D
E
F
B
LG
LR
BZ
BZ
L1
Y
O
Y/W
O/W
W
B
キャリヤ前進指令
CARRIER FOWARD
キャリヤ後退指令
CARRIER BACKWARD
キャリヤ多段指令 1
CARRIER SPEED COM. 1
キャリヤ多段指令 2
CARRIER SPEED COM. 2
キャリヤインバータリセット指令
CARRIER INV. RESET
リフター下降指令
LIFTER DOWN
リフター上昇指令
LPITER UP
リフター多段指令 1
LIFTER SPEED COM. 1
リフター多段指令 2
LIFTER SPEED COM. 2
リフターインバータリセット指令
LIFTER INV. RESET
ドッフィング中通知回転灯
DOFFING LAMP
（LG）
異常通知回転灯
TROUBLE LAMP
（LR）
動作開始通知音
DOFFING START
BUZZER
（BZ1）
異常通知音
TROUBLE
BUZZER
（BZ2）
MESSRS.
REMARKS
DATE JUL. 3. 2011
APPLIED FOR FL200
NAME OF DRAWING
SEQUENCE DIAGRAM
DRAWN BY
KITAMURA
CHECKED BY
A.Kitamura
APPROVED BY
Y.Shinozaki
DRAWING NO.
FL-902-D000-06-3

[10] Circuit Diagram 7

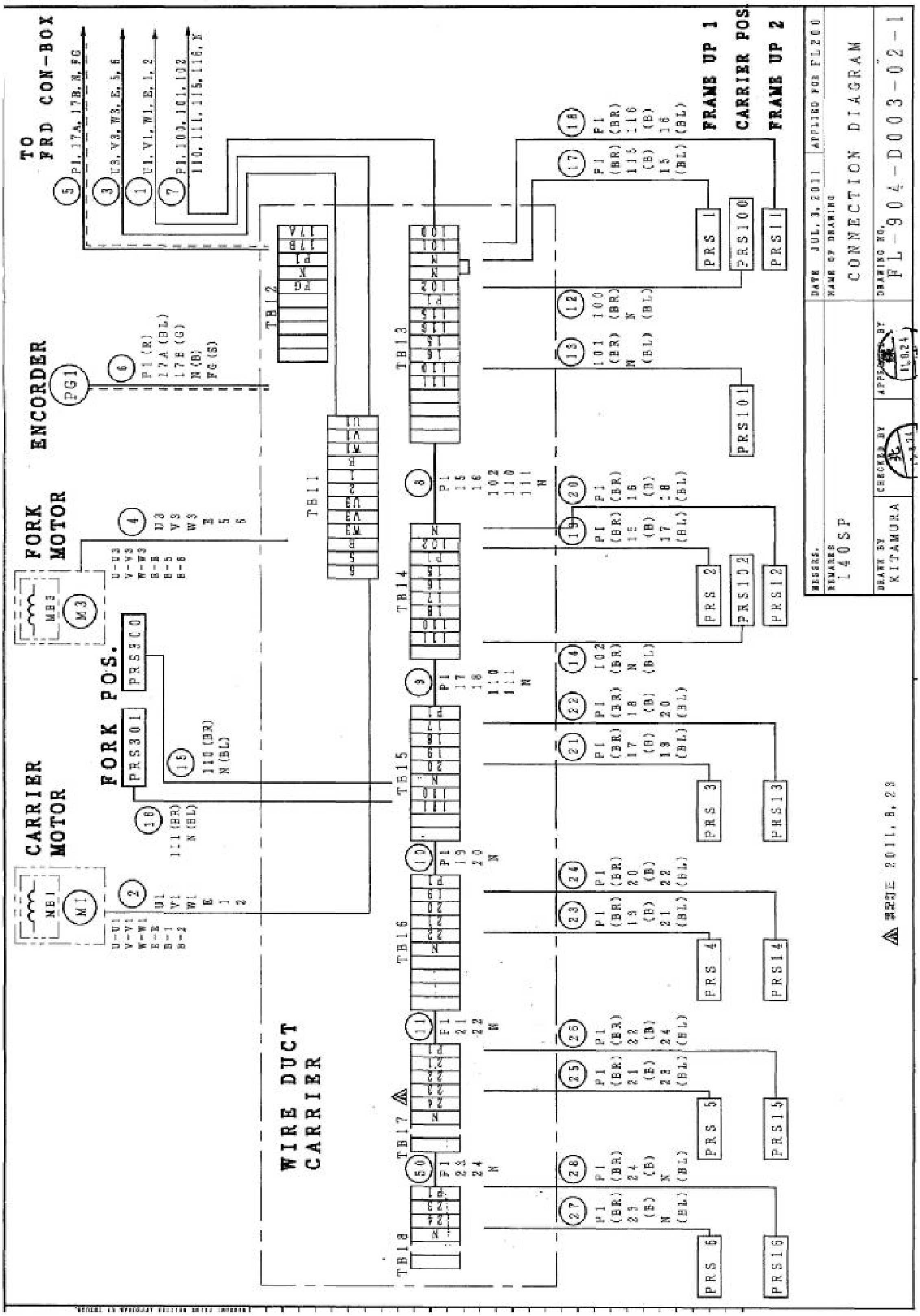

表示器
DISPLAY
N
P1
DISP
DC24V(-)
DC24V(+)
FG
170
171
CH6
CN2
SD
RD
RS
CS
DSR
SG
CD
ER
CN1
FG
SD
RD
RS
CS
SG
CD
ER
DISP
156
157
158
159
160
161
162
163
164
CH7
CN3
A12
A17
A15
A20
17B
17A
N
P1
D
W
G
R
FG1
165
166
167
168
169

A.2.2 Connection Diagram

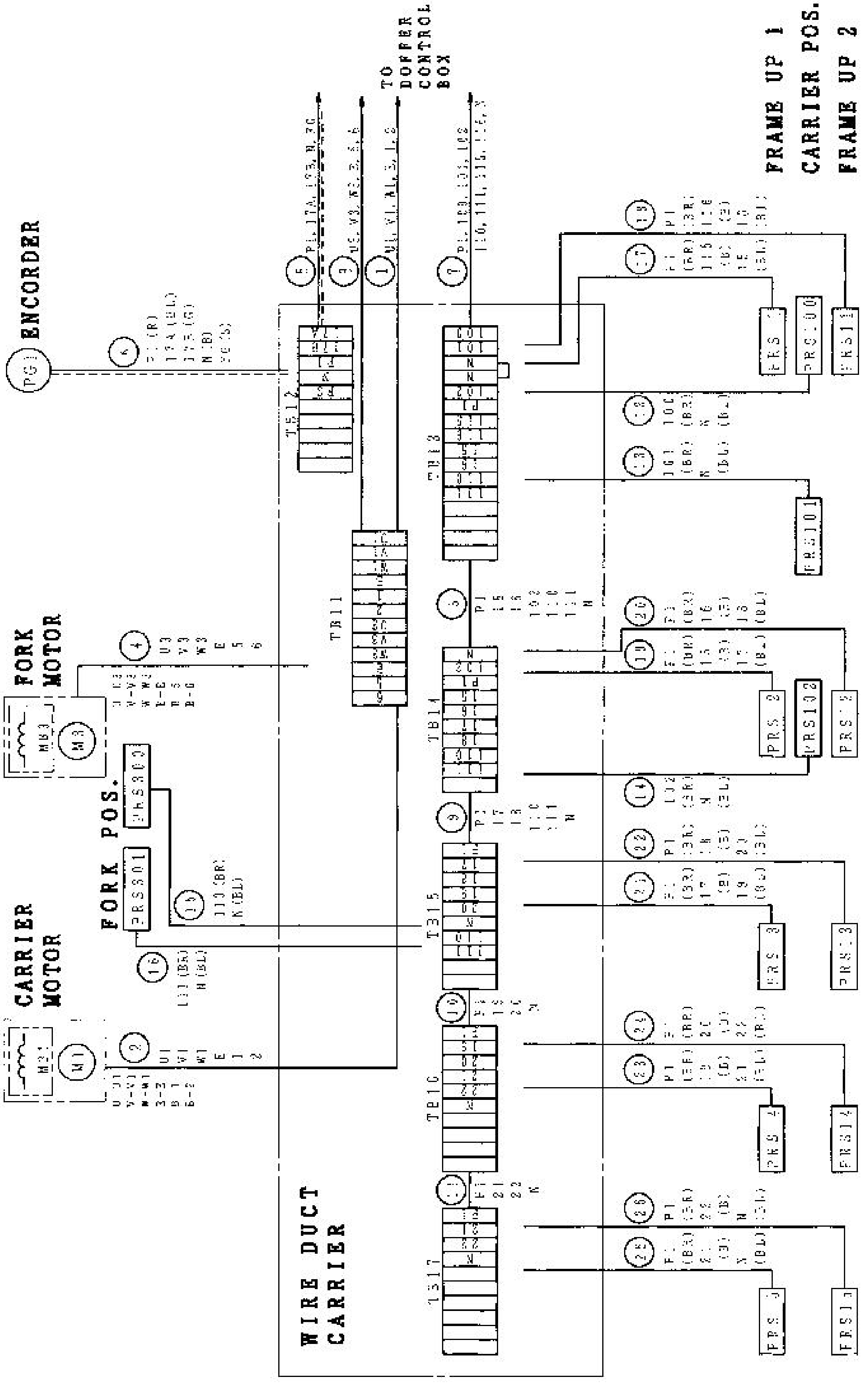
[1] Connection Diagram 1


DOFFER CONTROL BOX
(DOOR)
SEQ
(BOX)
CPU PS
NO.0 SLOT
NO.1 SLOT
NO.2 SLOT
NO.3 SLOT
NO.4 SLOT
NO.5 SLOT
NO.6 SLOT
NO.7 SLOT
TB2
TB3
TB1
EARTH BLOCK
CB1
CB1 & EARTH BLOCK
CB2 & EARTH BLOCK
FROM CB11
FROM CB11
FROM LIFTER M2
FROM FL MAIN-BOX
FROM TB21
FROM TB22
FROM LAMP AND BUZZER
FROM TB31
FROM TB32
FROM TB35
FROM TB37
FROM EMERGENCY STOP PB3
FROM TB12
FROM TB13
FROM PHS7, PHS8
FROM PHS7, PHS8
FROM FL SUB-BOX

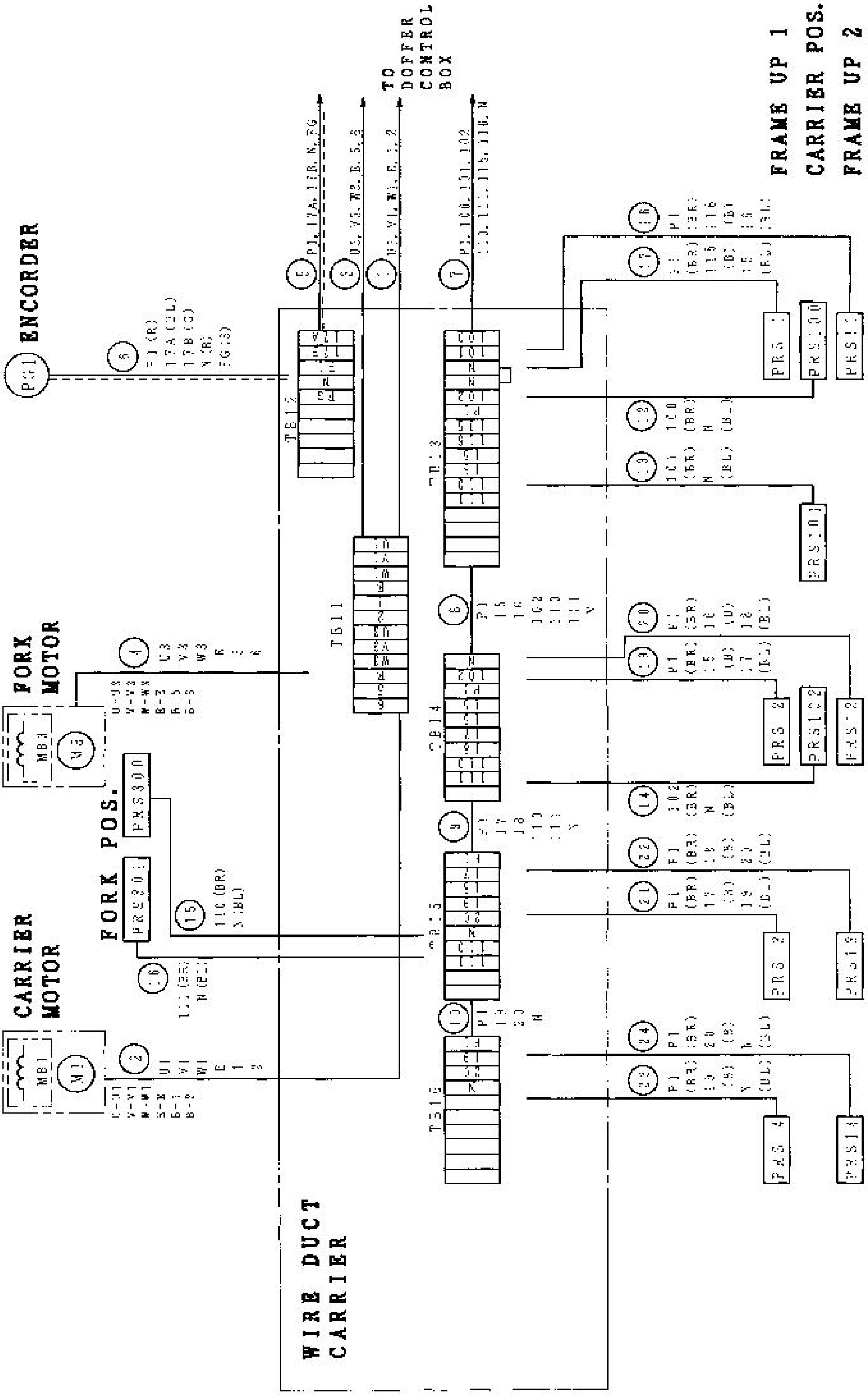
[2] Connection Diagram 2 (Number of Spindles: 140)


TO FRD CON-BOX
P1, 17A, 17B, N, FG
U3, V3, W3, E, 5, 6
U1, V1, W1, E, 1, 2
P1, 100, 101, 102
110, 111, 115, 116, N
ENCORDER
PG1
P1 (R)
17A (BL)
17B (G)
N (B)
FG (S)
FORK MOTOR
MB3
M3
U3
V3
W3
E
5
6
CARRIER MOTOR
MB1
M1
U1
V1
W1
E
1
2
FORK POS.
PRS301
PRS300
110 (BR)
N (BL)
111 (BR)
N (BL)
TB11
TB12
TB13
TB14
TB15
TB16
TB17
TB18
WIRE DUCT CARRIER
PRS 1
PRS 2
PRS 3
PRS 4
PRS 5
PRS 6
PRS100
PRS101
PRS102
PRS11
PRS12
PRS13
PRS14
PRS15
PRS16
FRAME UP 1
CARRIER POS.
FRAME UP 2
P1
(BR)
(B)
(BL)
N
APPLIED FOR FL200
DATE JUL. 8. 2011
NAME OF DRAWING
CONNECTION DIAGRAM
DRAWING NO.
FL-904-D003-02-1
140SP
DRAWN BY
KITAMURA
CHECKED BY
APPROVED BY
2011. 8. 23

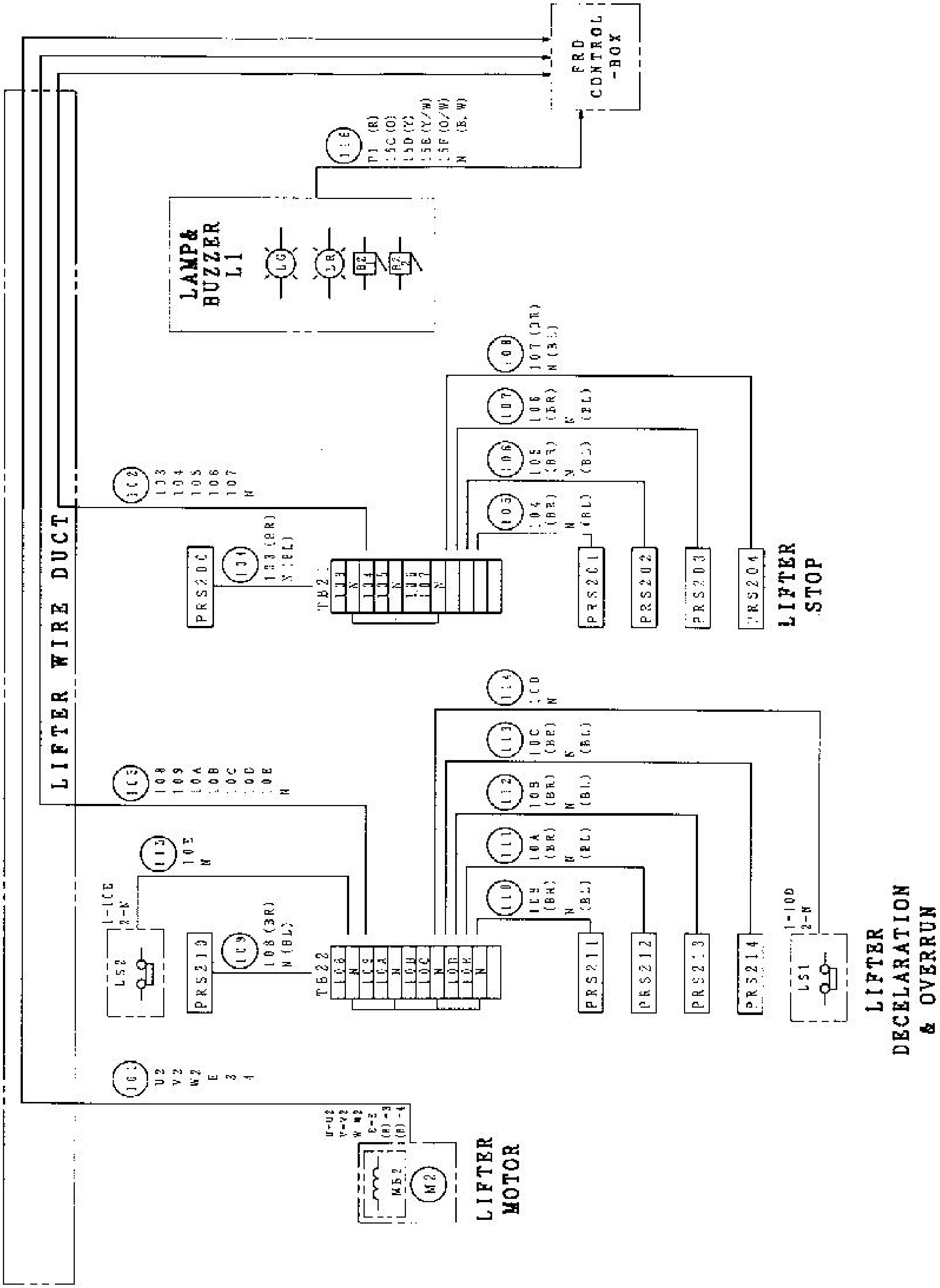
[3] Connection Diagram 2 (Number of Spindles: 108 or 120)


ENCORDER
PG1
FORK MOTOR
M3
CARRIER MOTOR
M1
FORK POS.
PRS301
PRS302
WIRE DUCT CARRIER
TO DOFFER CONTROL BOX
FRAME UP 1
CARRIER POS.
FRAME UP 2
TB12
TB13
TB11
TB14
TB15
TB16
TB17
PRS100
PRS101
PRS102

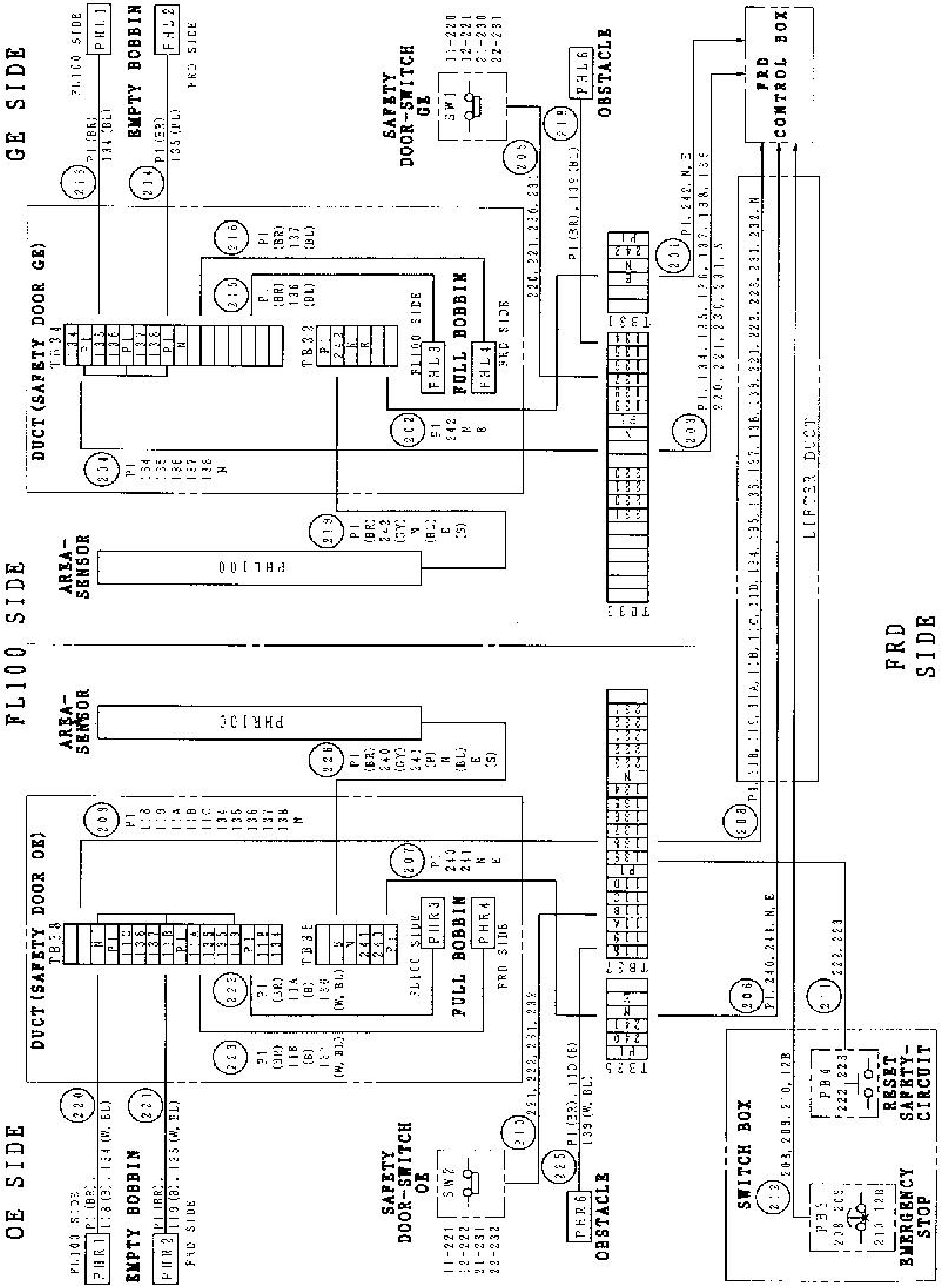
[4] Connection Diagram 2 (Number of Spindles: 96)


ENCORDER
PG1
FORK MOTOR
M3
MB3
CARRIER MOTOR
M1
MB1
FORK POS.
PRS300
PRS301
TO DOFFER CONTROL BOX
FRAME UP 1
CARRIER POS.
FRAME UP 2
TB12
TB11
TB13
TB14
TB15
TB16
PRS100
PRS101
PRS102
WIRE DUCT CARRIER

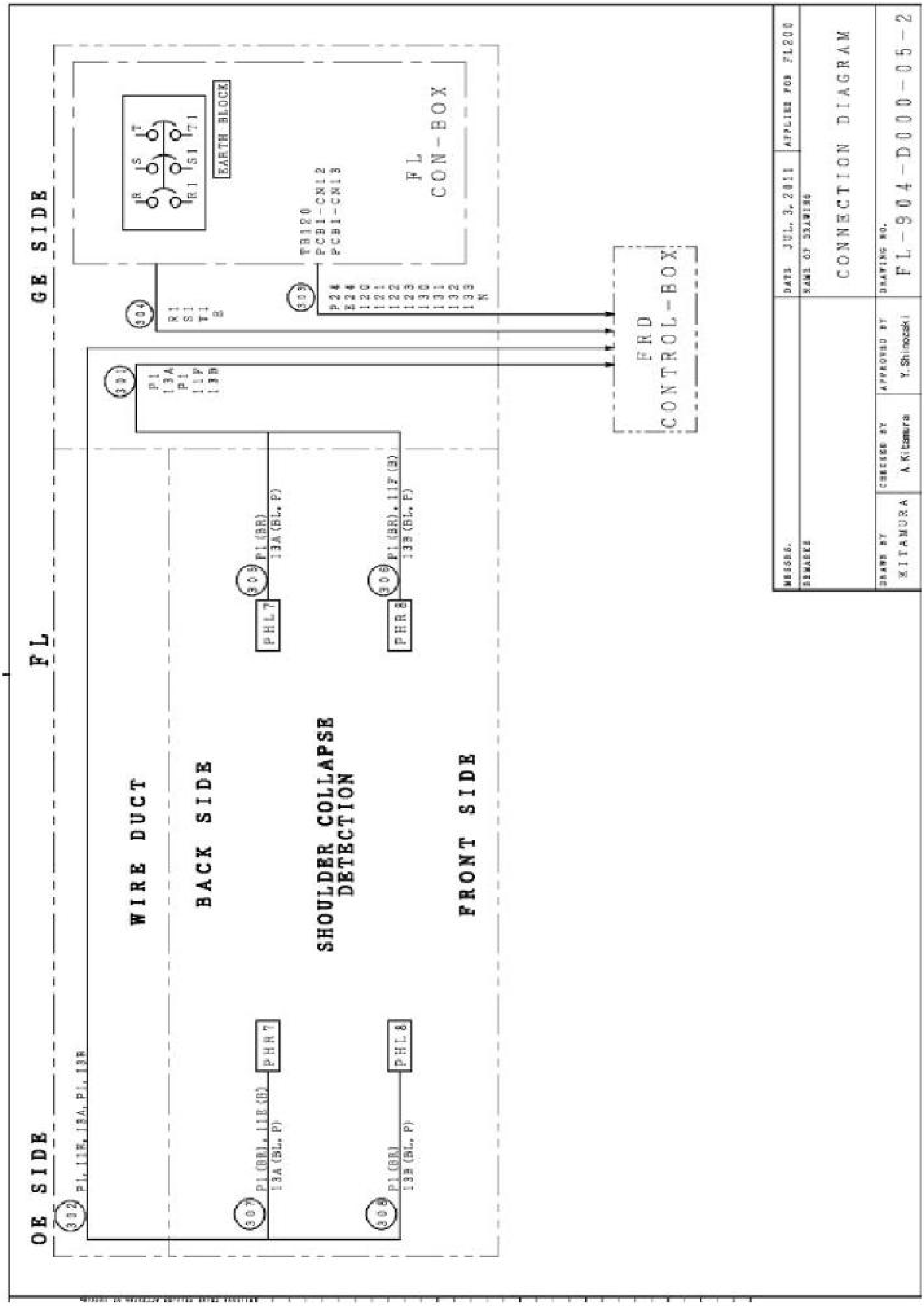
[5] Connection Diagram 3


FRD CONTROL -BOX
LAMP& BUZZER L1
LG
LR
BZ
TB21
TB22
PRS200
PRS201
PRS202
PRS203
PRS204
LIFTER STOP
PRS210
PRS211
PRS212
PRS213
PRS214
LS1
LS2
LIFTER DECELARATION & OVERRUN
LIFTER WIRE DUCT
M2
MB2
LIFTER MOTOR

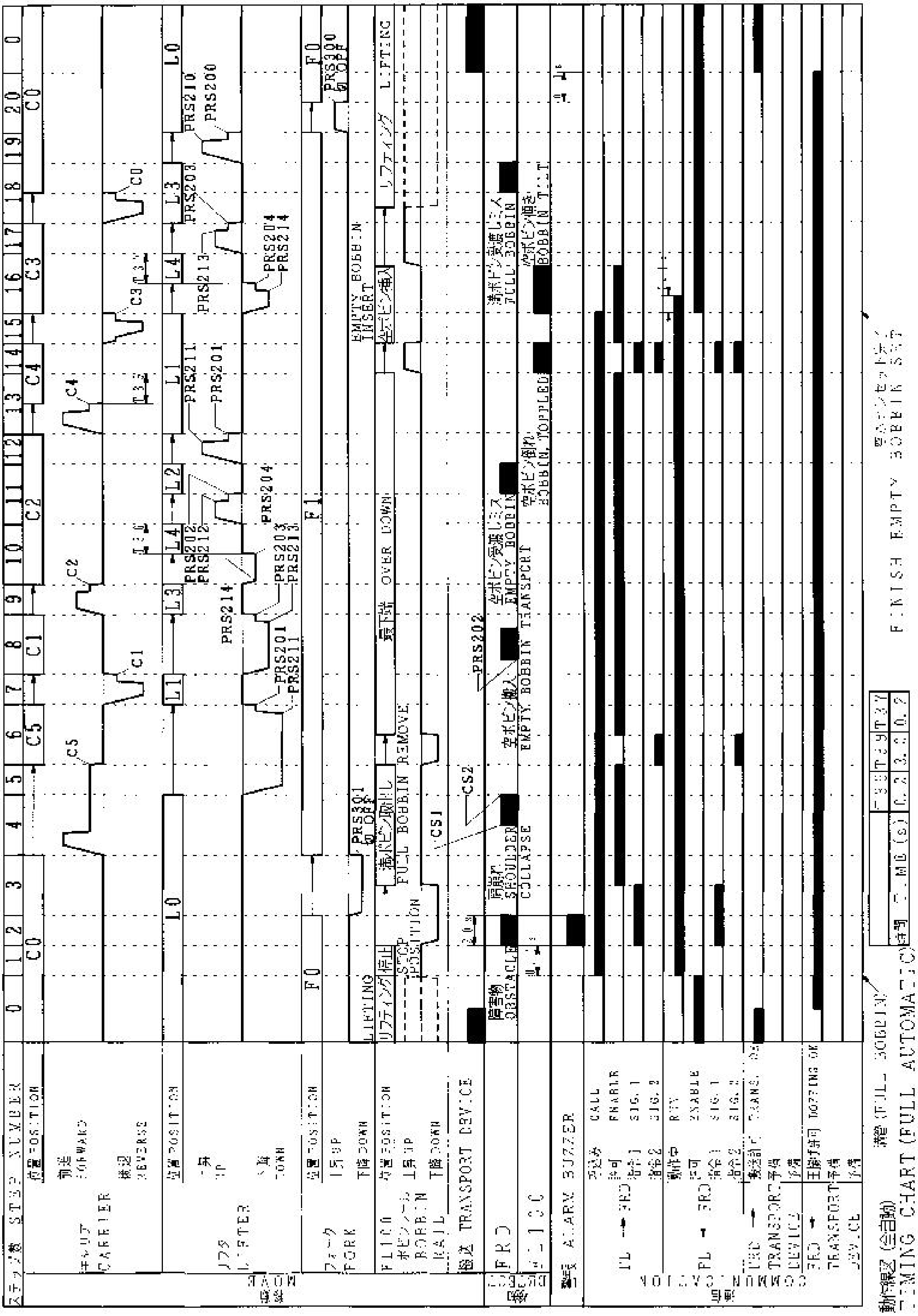
[6] Connection Diagram 4


GE SIDE
FL100 SIDE
OE SIDE
FRD SIDE
DUCT (SAFETY DOOR GE)
DUCT (SAFETY DOOR OE)
EMPTY BOBBIN
FULL BOBBIN
AREA-SENSOR
PHL100
PHR100
SAFETY DOOR-SWITCH GE
SAFETY DOOR-SWITCH OE
SW1
SW2
OBSTACLE
PHL6
PHR6
FRD CONTROL BOX
SWITCH BOX
EMERGENCY STOP
RESET SAFETY-CIRCUIT
PB3
PB4
LIFTER DUCT
TB34
TB38
TB33
TB32
TB31
TB35
TB36
PHL1
PHL2
PHL3
PHL4
PHR1
PHR2
PHR3
PHR4
FL100 SIDE
FRD SIDE

[7] Connection Diagram 5


GE SIDE
FL
OE SIDE
EARTH BLOCK
R
S
T
R1
S1
T1
TB120
PCB1-CN12
PCB1-CN13
FL
CON-BOX
FRD
CONTROL-BOX
304
R1
S1
T1
E
303
P24
E24
120
121
122
123
130
131
132
133
N
301
P1
13A
P1
11F
13B
302
P1, 11R, 13A, P1, 13B
WIRE DUCT
BACK SIDE
SHOULDER COLLAPSE
DETECTION
FRONT SIDE
305
P1(BR)
13A(BL, P)
PHL7
306
P1(BR), 11F(B)
13B(BL, P)
PHR8
307
P1(BR), 11R(B)
13A(BL, P)
PHR7
308
P1(BR)
13B(BL, P)
PHL8
MESSRS.
REMARKS
DATE JUL. 3, 2011
APPLIES FOR FL200
NAME OF DRAWING
CONNECTION DIAGRAM
DRAWN BY
KITAMURA
CHECKED BY
A.Kitamura
APPROVED BY
Y.Shimozaki
DRAWING NO.
FL-904-D000-05-2

A.2.3 Performance Chart


動作線図 (全自動) TIMING CHART (FULL AUTOMATIC)
満管 (FULL BOBBIN)
FINISH EMPTY BOBBIN SET
ステップ数 STEP NUMBER
キャリア CARRIER
位置 POSITION
前進 FORWARD
後退 REVERSE
リフタ LIFTER
上昇 UP
下降 DOWN
フォーク FORK
FLICC ボビンレール BOBBIN RAIL
搬送 TRANSPORT DEVICE
FRD
FLICC
警報 ALARM BUZZER
FL → FRD
FRD ← FL
FRD → TRANSPORT DEVICE
COMMUNICATION
CALL
ENABLE
SIG.1
SIG.2
RDY
TRANS. OK
DOFFING OK
C0
C1
C2
C3
C4
C5
L0
L1
L2
L3
L4
F0
F1
PRS200
PRS201
PRS202
PRS203
PRS204
PRS210
PRS211
PRS212
PRS213
PRS214
PRS300
PRS301
CS1
CS2
LIFTING
リフティング停止 STOP POSITION
満ボビン取出し FULL BOBBIN REMOVE
空ボビン挿入 EMPTY BOBBIN INSERT
行過ぎ OVER DOWN
リフティング LIFTING
障害物 OBSTACLE
肩当り SHOULDER
COLLAPSE
空ボビン搬入 EMPTY BOBBIN TRANSPORT
空ボビン受渡しミス EMPTY BOBBIN
空ボビン倒れ BOBBIN TOPPLED
満ボビン受渡しミス FULL BOBBIN
空ボビン傾き BOBBIN TILT
時間 TIME (s)
T30
T31
T32
T33
T34
T35
T36
T37
0.2
2.0
3.0
0.2